

**135-TRC-09-010**

**SAFETY COMPLIANCE TESTING FOR FMVSS 135  
Passenger Car Brake Systems**

Toyota Motor Corporation  
2009 Lexus ES 350, 4-Door Sedan  
NHTSA No. C95104

**TRANSPORTATION RESEARCH CENTER INC.**

10820 State Route 347  
East Liberty, Ohio 43319



Final Report Completed: June 1, 2009

FINAL REPORT

Prepared Under Contract No.: DTNH22-06-C-00033

**U.S. DEPARTMENT OF TRANSPORTATION  
National Highway Traffic Safety Administration  
Enforcement**

**Office of Vehicle Safety Compliance  
1200 New Jersey Avenue S.E.  
West Building 4<sup>th</sup> Floor  
OVSC (NVS-221)  
Washington, DC 20590**

Prepared for the Department of Transportation, National Highway Traffic Safety Administration, under Contract No. DTNH22-06-C-00033.

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Prepared By Nancy Landon  
Approved By Jeff Smiley  
Approval Date: 6/2/09

Final Report Acceptance By OVSC:

H. J. [Signature]  
Contract Technical Manager, Office of  
Vehicle Safety Compliance  
6/11/09  
Acceptance Date

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7. AUTHOR(S):  Project Manager: ALAN IDA  Project Engineer: RANDALL A. LANDES		8. PERFORMING ORGANIZATION REPORT NO.:  TRC-DOT-135-094	
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16. ABSTRACT:  Compliance tests were conducted on the subject 2009 Lexus ES 350, 4-Door Sedan, in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-135-01 for the determination of FMVSS 135 compliance. Test failures identified were as follows:  None.			
17. KEY WORDS:  Compliance Testing Safety Engineering FMVSS 135		18. DISTRIBUTION STATEMENT:  Copies of this report are available from: NHTSA Technical Information Services NPO-411 1200 New Jersey Ave, S.E. Washington, DC 20590 Email: <a href="mailto:tis@nhtsa.dot.gov">tis@nhtsa.dot.gov</a> FAX: 202-493-2833	
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## 1.0 INTRODUCTION

Tests were conducted on a 2009 Lexus ES 350, 4-Door Sedan, manufactured by Toyota Motor Corporation, to determine compliance with FMVSS 135 "Passenger Car Brake Systems." All tests were conducted in accordance with the U.S. D.O.T., NHTSA Laboratory Procedure TP 135-01 and/or the corresponding TRC Inc. Test Procedure that was submitted to NHTSA for their approval. The Test Procedure was clearly described in the submitted document and has not been repeated in this report.

All stops were performed manually.

All tests were conducted by TRC Inc. personnel using the following TRC facilities:

### 7.5-Mile Test Track

Vehicle Maximum Speed

Burnish

Heating Snubs and Hot Performance Stops

Brake Cooling and Recovery Stops

### Skid Pad

Cold Effectiveness Stops

High Speed Effectiveness Stops

Stops with Engine Off

Failed ABS

Failed Variable Proportioning Valve (if applicable)

Failed Hydraulic Circuits

Brake Power Assist Unit Failures

RBS Failure (if applicable)

EMF (Battery) Failure (if applicable)

### Brake Slope

Parking Brake

Average PFC during the test period was 0.94 (Skid Pad) and 0.92 (Test Track) utilizing the ASTM E1337 w/E1336 tire method.

The test vehicle was ABS equipped. Therefore, the Wheel Lock Sequence and Adhesion Utilization Tests were not performed.

This vehicle met the requirements of FMVSS 135.

# DATA SHEET 1 - VEHICLE INFORMATION

## VEHICLE SPECS

Year: 2009	NHTSA No: C95104
Mfr: TOYOTA MOTOR CORPORATION	GVWR (Kg): 2123
Make: LEXUS	GAWR Front(Kg): 1210
Model: ES 350	GAWR Rear(Kg): 1070
Body Style: 4 DOOR SEDAN	Wheelbase (mm): 2775.0
Mfr. Date: 10/08	Odometer: Start:121 MI. End:587
VIN: JTHBJ46GX92295416	

## BUSES ONLY

Chassis Mfg.: N/A  
 Serial No.: N/A  
 No. of Seats: N/A  
 Manufacture Date: N/A

Engine Type: GASOLINE,SFI,V-6, PISTON, DOHC, 24 V, W/DUAL VVT-I	Tire Size: P215/55R17
Displacement: 3.5 LITER	Tire Type: TURANZA EL400, HP,TUBELESS RAD
Engine Hspwr: 272	Tire Mfr.: BRIDGESTONE
Idle Speed(rpm): 726	GVWR Front Press.(kpa): 210
Transmission Type: AUTO.6-SPD,FWD	GVWR Rear Press.(kpa): 210
No. of Axles: 2	

## BRAKE APPLY SYSTEM

Brake Series: Front:DISC Rear:DISC	Power Assist Unit: YES
Brake Actuation	Pwr Unit w/Accumulator: NO
(Hydr. Circuit Split): DIAGONAL	Pwr Asst./Pwr Unit w/Backup: NO
Power Unit: VACUUM	Variable Prop. System: YES
Anti-Skid unit Mfr: ADVICS	Anti-Skid Device: YES
Parking Mechanism: YES	
Type of Parking Unit: AUTOMATIC TRANSMISSION W/PARK DETENT	
Mstr Cylinder Dia(mm): 22.20	Pedal Ratio: 2.56: 1

## FRONT SYSTEM BRAKE COMPONENT MATERIALS AND CONSTRUCTION:

BRAKE TYPE: DISC	Material: CAST
Drum Construction: N/A	LF Drum Shoe Cage Dia.(mm): 0.00
Disc Construction: CAST,VENTED	RF Drum Shoe Cage Dia.(mm): 0.00
Front Brake Dia.(mm): 296.12	LF Drum Dia. RESET(mm): 0.00
Fr Disc Thickness(mm): 27.99	RF Drum Dia. RESET(mm): 0.00
Lining Construction: Bonded	
FRONT BRAKE COMPONENT DIMENSIONS AND CODES:	
Inboard (Leading)	Outboard (Trailing)
Width(mm): 49.20	Width(mm): 49.22
Length(mm): 127.76	Length(mm): 127.76
Thickness(mm): 11.48	Thickness(mm): 11.48
Lining Code/Color: NBK PN562H FF	Lining Code/Color: NBK PN562H FF
Hyd. Piston Dia.(mm): 63.42 (X1)	

PLOTS\INTERPOS\SETUP + SETUP2

# DATA SHEET 1 - (CONTINUED)

## REAR SYSTEM

## BRAKE COMPONENT MATERIALS AND CONSTRUCTION:

BRAKE TYPE: DISC

Material: CAST

Drum Construction: N/A

LR Drum Shoe Cage Dia. (mm): 0.00

Disc Construction: CAST, UNVENTED

RR Drum Shoe Cage Dia. (mm): 0.00

Lining Construction: BONDED

LR Drum Dia. RESET (mm): 0.00

Rear Brake Dia. (mm): 281.00

RR Drum Dia. RESET (mm): 0.00

Rr Disc Thickness (mm): 9.98

Lining Construction: Bonded

### REAR BRAKE COMPONENT DIMENSIONS AND CODES:

Inboard (Leading)

Outboard (Trailing)

Width (mm): 41.45

Width (mm): 41.53

Length (mm): 80.62

Length (mm): 80.60

Thickness (mm): 10.28

Thickness (mm): 10.39

Lining Code/Color: NBK D6247-FF

Lining Code/Color: NBK D6247-FF

Hyd Piston Dia (mm): 38.04 (X1)

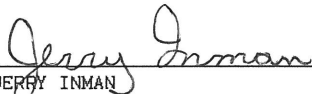
### OTHER COMPONENT INFORMATION:

Friction-type Park Brake: N/A

Non-Service Brake Type

Parking Brake: FOOT-OPERATED

NOTE: If at any time after the test series has begun, any brake system part requires replacement or the brake system requires adjustments other than permitted in burnish and reburnish procedures, discontinue testing and notify the COTR immediately.

Technician: 

JERRY INMAN

Date: 6/2/09

Quality Assurance:

  
RANDY LANDES

**3.0 SUMMARY OF TESTING**

		Specification and Limit				TEST RESULTS (In compliance if one stop meets requirement)			
TEST	Loading Conditio n	Speed (km/h)	Min. Pedal Force (N)	Max. Pedal Force (N)	Stopping Distance Requirement (m)	Shortest Stop Min. Pedal Force (N)***	Shortest Stop Max. Pedal Force Newtons (Average – N)	Shortest Stop Stopping Distance (m) (Corrected)	PASS Fail
Equipment Requirements					Specified Equipment	Vehicle contains specified equipment			Pass
Vehicle Maximum Speed	LLVW	NA				221.2 km/h avg.			NA
Burnish	GVWR	80				200, 80 - 0 km/h stops @ 3.0 mpsps			NA
Wheel Lockup Sequence w/o ABS	GVWR				Lockup of front wheels prior to rear	ABS equipped – not required.			NA
Wheel Lockup Sequence w/o ABS	LLVW					ABS equipped – not required.			NA
Adhesion Utilization w/o ABS	LLVW				Rear axle adhesion utilization curve below specified value	ABS equipped – not required.			NA
Adhesion Utilization w/o ABS	GVWR					ABS equipped – not required.			NA
Cold Effectiveness	GVWR	100	65	500	70	5	475.5	47.5	Pass
High Speed Effectiveness	GVWR	160.0	65	500	spd. depend. – 187.5	5	495.9	120.7	Pass
Stops with Engine Off	GVWR	100	65	500	70	5	483.1	49.6	Pass
Cold Effectiveness	LLVW	100	65	500	70	5	497.9	45.4	Pass
High Speed Effectiveness	LLVW	160.0	65	500	spd. depend. – 187.5	5	473.2	113.0	Pass
Failed Antilock	LLVW	100	65	500	85	5	264.2	55.1	Pass
Failed Proportioning Valve	LLVW	100	65	500	110	5	NA	NA	NA
Failed Hydraulic Circuit #1	LLVW	100	65	500	168	5	488.5	87.5	Pass
Failed Hydraulic Circuit #2	LLVW	100	65	500	168	5	489.4	90.6	Pass
Failed Hydraulic Circuit #1	GVWR	100	65	500	168	5	467.6	100.0	Pass
Failed Hydraulic Circuit #2	GVWR	100	65	500	168	5	498.0	104.7	Pass
Failed Antilock	GVWR	100	65	500	85	5	179.2	57.2	Pass
Failed Proportioning Valve	GVWR	100	65	500	110	5	NA	NA	NA
Regenerative Brake System (RBS) Failure	GVWR	100	65	500	168	5	NA	NA	NA
Electromotive Force (EMF) – Battery Failure	GVWR	100	65	500	70	5	NA	NA	NA
Power Brake Unit Failure	GVWR	100	65	500	168	5	498.6	143.2	Pass
Parking Brake - Uphill	GVWR	-	-	500	Hold for 5 min.?	NA	449.6	Yes-Holds	Pass
Parking Brake - Downhill	GVWR	-	-	500	Hold for 5 min.?	NA	482.3	Yes-Holds	Pass
Heating Snubs	GVWR	120-60	NA	NA	15 Snubs- 3.0 mpsps	5	51 Vis. Avg.	NA	NA
Hot Performance Stop #1	GVWR	100	65	383 <b>avg</b>	73.0	5	402.0 (288.9)	59.1	Pass
Hot Performance Stop #2	GVWR	100	65	500	89	5	485.9 (411.6)	54.5	Pass
Brake Cooling	GVWR	50	NA	NA	4 Stops - 3.0 mpsps	5	45 Vis. Avg.	NA	NA
Recovery Performance Stop #1	GVWR	100	65	383 <b>avg</b>	One of the two stops between 35.2 and 64.0 meters.	5	405.0 (322.2)	50.2	Pass
Recovery Performance Stop #2	GVWR	100	65	383 <b>avg</b>		5	406.6 (280.1)	48.0	
Final Inspection-Brake Integrity	Check components for detachment, fracture or lubricants.					No detachments or fractures-normal appear. & colr.			Pass
Final Inspection-Reservoirs/Warning Indicators	Master cylinder or brake power reservoir shall meet the volume and label requirements of S5.4.2 and S5.4.3.					Brake system has sufficient capacity and indicators are in compliance.			Pass

\*\*\* Note: The Shortest Stop Minimum Pedal Force represents the minimum force value required to engage the data acquisition's recording mode.

# DATA SHEET 3 - VEHICLE WEIGHT

VEHICLE: 2009 LEXUS ES 350

NHTSA No. C95104 Date: 05/04/09

Tire Pressure(cold): Front (kpa) 210 Rear (kpa) 210

Odometer: Start 121 MI. End 587

Scale(s) Used: TRC Scales

NOTE: GVWR, LLVW and axle weights to be measured within +0% and -1%.

## GVWR/GAWR INFORMATION

(From Veh. Certification Label)

GVWR(Kg): 2123

GAWR Front(Kg): 1210

GAWR Rear(Kg): 1070

## UNLOADED VEHICLE WEIGHT(UVW)

L Front(Kg): 482 L Rear(Kg): 344

R Front(Kg): 510 R Rear(Kg): 314

T Front(Kg): 992 T Rear(Kg): 658

Total UVW(Kg): 1650

## TARGET LIGHT LOADED WEIGHT(LLVW):

## ACTUAL LIGHT LOADED WEIGHT(LLVW):

NOTE 1: LLVW = UVW+181.4Kg

NOTE 2: Weight distributed in front passenger seat area.

NOTE 3: Neither axle load at LLVW less than at UVW; ballast as required.

L Front(Kg): 531 L Rear(Kg): 388

R Front(Kg): 556 R Rear(Kg): 357

T Front(Kg): 1087 T Rear(Kg): 745

Total LLVW(Kg): 1832

L Front(Kg): 530 L Rear(Kg): 388

R Front(Kg): 557 R Rear(Kg): 357

T Front(Kg): 1087 T Rear(Kg): 745

Total Actual Test LLVW(Kg): 1832

Load: Driver/Observer 91(Kg) + Instru. 41(Kg) + Ballast 50(Kg) = 182(Kg)

## FULLY LOADED TEST WEIGHT (ACTUAL GVWR)

NOTE 1: Vehicle loaded so axle loads proportional to GAWR shown previously.

NOTE 2: But no axle weight to be less than at LLVW.

NOTE 3: If weight on any axle at LLVW exceeds the axle's proportional share of the GVWR, the load required to reach GVWR is placed so that the weight on that axle remains the same as at LLVW.

L Front(Kg): 540 L Rear(Kg): 515

R Front(Kg): 585 R Rear(Kg): 483

T Front(Kg): 1125 T Rear(Kg): 998

Total Fully Loaded GVWR(Kg): 2123

Load: Driver/Observer 91(Kg) + Instru. 41(Kg) + Ballast 341(Kg)= 473(kg)

Technician: Jerry Inman  
JERRY INMAN

Date: 6/2/09

Quality Assurance:

Randy Landes  
RANDY LANDES

## DATA SHEET 4 - EQUIPMENT REQUIREMENTS (S5)

### SERVICE BRAKE SYSTEM (S5.1)

Vehicle equipped with a service brake system acting on all wheels? YES

Wear Adjustment (S5.1.1):

Service Brakes are compensated for wear by means of a system of automatic adjustment? YES

Describe: DISC:AUTOMATIC CLEARANCE TAKE-UP.

Wear Status (S5.1.2):

Wear status of service brakes is indicated by:

(A) Acoustic or optical device? YES

Describe: METAL TAB EMITS HIGH FREQUENCY SQUEAL WHEN WORN.

(B) Visual check outside or under vehicle? YES

Describe: FRONT AND REAR:LOOK THROUGH CALIPER.

### PARKING BRAKE SYSTEM (S5.2)

Vehicle equipped with a parking brake system of a friction type with solely mechanical means to retain engagement: YES

### CONTROLS (S5.3)

(A) Service brakes activated by means of a foot control? YES

(B) Parking brake control is independent of the service brake control? YES

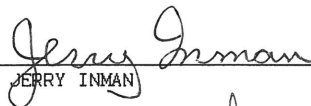
(C) Parking brake control is hand or foot operated? YES

(D) ABS, if equipped, cannot be manually disabled? YES

DATA INDICATES COMPLIANCE:

COMMENTS: NONE.

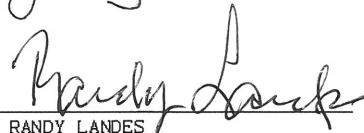
Tester/Technician:

  
JERRY INMAN

Date:

6/2/09

Quality Assurance:

  
RANDY LANDES

# DATA SHEET 5 - VEHICLE MAX SPEED

VEHICLE: 2009 LEXUS ES 350

NHTSA No. C95104

Date: 05/04/09

Ambient Temperature: 67°F

Wind Velocity: 6(MPH)

Road PFC: .92

Wind Direction: 89°

Odometer: Start 133(mi) End 149(mi)

TEST WEIGHT: Total (Kg): 1832

Front (Kg): 1087

Rear (Kg): 745

## ESTABLISH VEHICLE MAXIMUM SPEED

VEHICLE LOAD: LLVW

IBT: N/A

GEAR: Drive

DECEL RATE: N/A

PEDAL FORCE: N/A

WHEEL LOCKUP: N/A

TEST SPEED: Maximum attainable from

INTERVAL: N/A

a standing start in 3.2 km.

1. Ballast Vehicle to LLVW
2. Accelerate at a maximum rate from a standing start for a distance of 3.2 km on a level surface.
3. Repeat in opposite direction.
4. Record speed attained in each direction and use the average of the two runs.

	DIRECTION	MAX SPEED (km/h)		Time 0 - 100 km/h (seconds)
		Visual	Recorded	
Run No. 1	South	223	222.3	9.72
Run No. 2	North	221	220.2	8.52

AVERAGE = 221.2 km/h

COMMENTS: INV DATA, Section 0001, 05/04/09, 15:34:22

Tester/Technician:

*Jerry Inman*  
JERRY INMAN

Date:

6/2/09

Quality Assurance:

*Randy Landes*  
RANDY LANDES

Vehicle: 2009 TOYOTA MOTOR CO NHTSA NUMBER: C95104  
 Make: LEXUS  
 Model: ES 350  
 Body Style: 4 DOOR SEDAN  
 Front Cold Tire Pressure: 210 (Kpa)  
 Rear Cold Tire Pressure: 210 (Kpa)

Transportation Research Center, Inc.  
 10820 State Route 347  
 East Liberty, Ohio 43319  
 (937) 666-2011 www.trcpg.com

Date Tested: 05/05/09

## DATA SHEET 6 - BURNISH AT GVWR

Testing Conditions: INV DATA, Section 0002, 05/05/09, 09:25:25

Weather Conditions: 58°F Wind: 3 mph 93°

Start Odo.: 162 End Odo.: 457

### Schedule:

Initial Brake Temperature Less Than 100°C  
 Initial Speed 80 km/h to zero  
 200 stops with transmission in gear

### Performance Requirements:

Interval between runs: Time necessary to reduce IBT to 100 C° or 2 km distance, whichever occurs first.  
 Constant decel rate: 3.0 m/s<sup>2</sup>  
 Pedal force adjusted to maintain constant decel.  
 No Lock-Up allowed longer than 0.1 sec above 15 km/h  
 Vehicle Must stay in lane of 3.5m

STOP	INIT	LEFT	RIGHT	LEFT	RIGHT	MAX.	AVG.	
#	SPD	FRONT	FRONT	REAR	REAR	PEDAL	PEDAL	AVG.
	(kph)	IBT	IBT	IBT	IBT	FORCE	FORCE	DECEL
		(°C)	(°C)	(°C)	(°C)	(N)	(N)	(m/sec <sup>2</sup> )
=====	=====	=====	=====	=====	=====	=====	=====	=====
1	81.08	46	47	45	48	66.12	41.17	2.83
10	80.79	99	93	94	104	57.80	37.76	3.16
20	80.09	97	87	92	102	69.52	45.21	2.96
30	80.64	104	93	98	106	63.81	43.77	2.82
40	81.23	107	89	99	107	62.94	45.21	3.00
50	80.42	107	88	99	106	63.06	43.48	3.03
60	81.00	114	94	103	109	58.84	40.77	3.01
70	80.46	113	91	101	108	57.05	41.00	3.04
80	81.18	111	89	97	105	69.41	46.02	3.25
90	80.93	116	90	99	106	61.09	38.92	2.88
100	80.02	111	89	99	104	57.97	43.37	3.00
110	79.46	105	83	95	101	67.04	46.19	3.03
120	81.40	111	88	91	96	68.72	41.92	3.19
130	79.32	98	81	86	91	55.49	38.92	2.92
140	80.16	122	90	95	101	58.73	43.08	3.05
150	81.48	122	95	98	102	65.42	45.39	2.93
160	80.67	128	94	99	104	62.83	45.04	3.11
170	79.94	102	87	87	93	49.55	33.19	3.14
180	80.56	109	89	89	94	57.45	41.08	3.06
190	80.94	114	86	88	93	59.58	42.23	3.18
200	80.82	104	79	84	90	61.71	41.48	2.95

COMMENTS: THIS VEHICLE ABS EQUIPPED. DATA SHEETS 7-10 NOT INCLUDED.

## BRAKE ADJUSTMENT

### Schedule:

Adjust service brakes; record procedure and amount adjusted.

Left Front: DISC NONE  
 Right Front: DISC NONE  
 Left Rear: DISC NONE  
 Right Rear: DISC NONE

DATA INDICATES COMPLIANCE: YES (X) NO ( )

Driver: JERRY INMAN

Observer: NONE

Recorded Data Processed by: CHUCK JENKINS

Date: 05/18/09

Approving Laboratory Official: RANDY LANDES

Date: 05/19/09

Vehicle: 2009 TOYOTA MOTOR CO NHTSA NUMBER: C95104 Transportation Research Center, Inc.  
 Make: LEXUS 10820 State Route 347  
 Model: ES 350 East Liberty, Ohio 43319  
 Body Style: 4 DOOR SEDAN (937) 666-2011 www.trcpg.com  
 Front Cold Tire Pressure: 210 (Kpa)  
 Rear Cold Tire Pressure: 210 (Kpa) Date Tested: 05/07/09

## DATA SHEET 11 - COLD EFFECTIVENESS AT GVWR

Testing Conditions: INV DATA, Section 0015, 05/07/09, 12:30:21

Weather Conditions: 62°F Wind: 11 mph 207° Start Odo.: 467 End Odo.: 475

### Schedule:

Initial Brake Temperature 65 - 100 C  
 Initial Speed 100 km/h to zero  
 6 stops with transmission in neutral

### Performance Requirements:

One Stop with:  
 Stopping Distance less than 70m  
 Pedal force between 65N and 500N  
 No Lock-Up allowed longer than 0.1 sec above 15 km/h  
 Vehicle Must stay in lane of 3.5m

		LEFT	RIGHT	LEFT	RIGHT		CORRECTED	MAX.	AVG.		
	INIT	FRONT	FRONT	REAR	REAR	ACTUAL	DISTANCE	PEDAL	PEDAL	MAX.	AVG.
STOP	SPD	IBT	IBT	IBT	IBT	DISTANCE	(SAE 299)	FORCE	FORCE	DECEL	DECEL
#	(kph)	(°C)	(°C)	(°C)	(°C)	(meter)	(meter)	(N)	(N)	(m/sec <sup>2</sup> )	(m/sec <sup>2</sup> )
=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====
1	100.24	87	76	59	54	49.5	49.3	468.61	346.86	12.19	5.71
2	99.50	93	82	68	61	50.2	50.7	492.35	433.11	11.23	7.88
3	100.22	88	78	63	56	47.8	47.5	475.52	383.22	12.60	7.35
4	100.37	87	76	63	57	48.3	47.9	491.60	416.75	13.87	8.18
5	100.40	94	82	70	64	51.0	50.6	486.64	422.80	11.63	7.68
6	100.08	94	84	66	59	49.5	49.4	497.19	401.08	11.97	7.37

STOP DRIVER VEHICLE STOP COMMENTS  
 # (Wheel Lock up - Direction of Stop - Stay in Lane)

=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====
1	-			NOX		SOUTH		YES			
2	-			NOX		SOUTH		YES			
3	-			NOX		SOUTH		YES			
4	-			NOX		SOUTH		YES			
5	-			NOX		SOUTH		YES			
6	-			NOX		SOUTH		YES			

Corrected Distances are used to determine shortest stopping distance.

DATA INDICATES COMPLIANCE: YES (X) NO ( )

Driver: JERRY INMAN Observer: NONE  
 Recorded Data Processed by: CHUCK JENKINS Date: 05/18/09  
 Approving Laboratory Official: RANDY LANDES Date: 05/19/09

Vehicle: 2009 TOYOTA MOTOR CO	NHTSA NUMBER: C95104	Transportation Research Center, Inc.
Make: LEXUS		10820 State Route 347
Model: ES 350		East Liberty, Ohio 43319
Body Style: 4 DOOR SEDAN		(937)666-2011 www.trcpg.com
Front Cold Tire Pressure: 210 (Kpa)		
Rear Cold Tire Pressure: 210 (Kpa)		Date Tested: 05/07/09

## DATA SHEET 12 - HIGH SPEED EFFECTIVENESS AT GVWR

Testing Conditions: INV DATA, Section 0020, 05/07/09, 13:14:08

Weather Conditions: 65°F      Wind: 11 mph 254°      Start Odo: 476      End Odo: 482

### Schedule:

Initial Brake Temperature: 65-100°C  
Initial Speed: 80% max km/h, not greater than 160km/h  
6 stops with transmission in gear  
Target Initial Speed: 160.00 kph

### Performance Requirements:

One Stop with:  
Stopping Distance less than: 187.5 meter  
Pedal force between 65N and 500N  
No Lock-Up allowed longer than 0.1 sec above 15 km/h  
Vehicle Must stay in lane of 3.5m

STOP #	INIT SPD	LEFT FRONT	RIGHT FRONT	LEFT REAR	RIGHT REAR	ACTUAL DISTANCE	CORRECTED DISTANCE	MAX. PEDAL FORCE	AVG. PEDAL FORCE	MAX. DECEL	AVG. DECEL
	(kph)	(°C)	(°C)	(°C)	(°C)	(meter)	(SAE 299) (meter)	(N)	(N)	(m/sec <sup>2</sup> )	(m/sec <sup>2</sup> )
1	160.16	76	65	53	47	121.0	120.8	481.11	409.78	13.03	8.60
2	160.07	92	73	54	46	120.8	120.7	495.92	438.41	12.77	8.46
3	158.62	97	77	57	46	121.2	123.3	492.81	419.98	12.57	8.24
4	159.54	97	71	52	42	123.2	123.9	504.27	432.65	12.36	8.23
5	158.74	97	79	52	45	123.8	125.8	469.30	384.37	11.68	7.42
6	159.12	98	78	51	44	123.5	124.8	574.51	411.05	12.10	7.93

STOP #	DRIVER VEHICLE STOP COMMENTS		
	(Wheel Lock up - Direction of Stop - Stay in Lane)		
1	-	NOX	SOUTH YES
2	-	NOX	SOUTH YES
3	-	NOX	SOUTH YES
4	-	NOX	SOUTH YES
5	-	NOX	SOUTH YES
6	-	NOX	SOUTH YES

DATA INDICATES COMPLIANCE:      YES (X)      NO ( )

Driver: JERRY INMAN	Observer: NONE
Recorded Data Processed by: CHUCK JENKINS	Date: 05/18/09
Approving Laboratory Official: RANDY LANDES	Date: 05/19/09

Vehicle: 2009 TOYOTA MOTOR CO	NHTSA NUMBER: C95104	Transportation Research Center, Inc.
Make: LEXUS		10820 State Route 347
Model: ES 350		East Liberty, Ohio 43319
Body Style: 4 DOOR SEDAN		(937) 666-2011 www.trcpg.com
Front Cold Tire Pressure: 210 (Kpa)		
Rear Cold Tire Pressure: 210 (Kpa)		Date Tested: 05/07/09

## DATA SHEET 13 - STOPS WITH ENGINE OFF AT GVWR

Testing Conditions: INV DATA, Section 0025, 05/07/09, 14:50:33

Weather Conditions: 67°F      Wind: 11 mph 209°      Start Odo.: 483      End Odo.: 490

Schedule:

Initial Brake Temperature: 65-100°C  
Initial Speed 100 km/h to zero  
6 stops with transmission in neutral

Performance Requirements:

One Stop with:  
Stopping Distance less than 70m  
Pedal force between 65N and 500N  
No Lock-Up allowed longer than 0.1 sec above 15 km/h  
Vehicle Must stay in lane of 3.5m

STOP #	INIT SPD	LEFT FRONT	RIGHT FRONT	LEFT REAR	RIGHT REAR	ACTUAL DISTANCE	CORRECTED DISTANCE	PEDAL FORCE	MAX. PEDAL FORCE	AVG. PEDAL FORCE	MAX. DECEL	AVG. DECEL
	(kph)	(°C)	(°C)	(°C)	(°C)	(meter)	(meter)	(N)	(N)	(N)	(m/sec²)	(m/sec²)
1	100.09	97	79	58	55	51.2	51.1	474.77	355.62	12.37	12.37	7.17
2	100.09	98	81	58	52	51.1	51.0	481.86	392.44	11.32	11.32	7.70
3	100.87	96	78	55	49	50.5	49.6	483.07	412.37	12.39	12.39	7.92
4	100.05	97	82	56	53	50.7	50.7	498.86	433.17	11.71	11.71	7.78
5	100.72	98	82	56	52	51.0	50.2	531.06	392.78	12.23	12.23	7.95
6	100.74	98	85	57	53	50.7	50.0	503.70	414.33	12.06	12.06	7.80

STOP #	DRIVER VEHICLE STOP COMMENTS		
#	(Wheel Lock-Up - Direction of Stop - Stay in Lane)		
1	-	NOX	SOUTH YES
2	-	NOX	SOUTH YES
3	-	NOX	SOUTH YES
4	-	NOX	SOUTH YES
5	-	NOX	SOUTH YES
6	-	NOX	SOUTH YES

DATA INDICATES COMPLIANCE:      YES (X)      NO ( )

Driver: JERRY INMAN	Observer: NONE
Recorded Data Processed by: CHUCK JENKINS	Date: 05/18/09
Approving Laboratory Official: RANDY LANDES	Date: 05/19/09

Vehicle: 2009 TOYOTA MOTOR CO	NHTSA NUMBER: C95104	Transportation Research Center, Inc.
Make: LEXUS		10820 State Route 347
Model: ES 350		East Liberty, Ohio 43319
Body Style: 4 DOOR SEDAN		(937) 666-2011 www.trcpg.com
Front Cold Tire Pressure: 210 (Kpa)		
Rear Cold Tire Pressure: 210 (Kpa)		Date Tested: 05/08/09

## DATA SHEET 14 - COLD EFFECTIVENESS AT LLVW

Testing Conditions: INV DATA, Section 0030, 05/08/09, 10:25:06

Weather Conditions: 63°F Wind: 6 mph 147° Start Odo.: 500 End Odo.: 504

Schedule:

Initial Brake Temperature: 65-100°C  
Initial Speed 100 km/h to zero  
6 stops with transmission in neutral

Performance Requirements:

One Stop with:  
Stopping Distance less than 70m  
Pedal force between 65N and 500N  
No Lock-Up allowed longer than 0.1 sec above 15 km/h  
Vehicle Must stay in lane of 3.5m

		LEFT	RIGHT	LEFT	RIGHT		CORRECTED	MAX.	AVG.		
	INIT	FRONT	FRONT	REAR	REAR	ACTUAL	DISTANCE	PEDAL	PEDAL	MAX.	AVG.
STOP	SPD	IBT	IBT	IBT	IBT	DISTANCE	(SAE 299)	FORCE	FORCE	DECEL	DECEL
#	(kph)	(°C)	(°C)	(°C)	(°C)	(meter)	(meter)	(N)	(N)	(m/sec²)	(m/sec²)
=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====
1	99.70	71	87	59	57	46.7	47.0	459.22	305.32	13.94	6.06
2	99.61	77	89	58	53	45.1	45.4	497.93	419.40	14.55	8.75
3	99.98	86	96	61	55	45.5	45.6	530.09	410.01	15.91	8.62
4	99.43	87	92	58	52	44.9	45.4	473.56	401.65	15.03	8.71
5	99.53	85	92	57	51	44.8	45.3	513.55	405.05	13.96	8.48
6	100.32	93	98	63	57	45.9	45.6	542.88	397.56	13.38	8.29

STOP	DRIVER VEHICLE STOP COMMENTS			
#	(Wheel Lock-Up - Direction of Stop - Stay in Lane)			
=====	=====	=====	=====	=====
1	-	NOX	SOUTH	YES
2	-	NOX	SOUTH	YES
3	-	NOX	SOUTH	YES
4	-	NOX	SOUTH	YES
5	-	NOX	SOUTH	YES
6	-	NOX	SOUTH	YES

DATA INDICATES COMPLIANCE: YES (X) NO ( )

Driver: JERRY INMAN	Observer: NONE
Recorded Data Processed by: CHUCK JENKINS	Date: 05/18/09
Approving Laboratory Official: RANDY LANDES	Date: 05/19/09

Vehicle: 2009 TOYOTA MOTOR CO NHTSA NUMBER: C95104  
 Make: LEXUS  
 Model: ES 350  
 Body Style: 4 DOOR SEDAN  
 Front Cold Tire Pressure: 210 (Kpa)  
 Rear Cold Tire Pressure: 210 (Kpa)

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Date Tested: 05/08/09

## DATA SHEET 15 - HIGH SPEED EFFECTIVENESS AT LLVW

Testing Conditions: INV DATA, Section 0035, 05/08/09, 11:08:14

Weather Conditions: 65°F Wind: 4 mph 166° Start Odo.: 505 End Odo.: 512

### Schedule:

Initial Brake Temperature: 65-100°C  
 Initial Speed: 80% max km/h  
 6 stops with transmission in gear

### Performance Requirements:

One Stop with:  
 Stopping Distance less than 187.5m  
 Pedal force between 65N and 500N  
 No Lock-Up allowed longer than 0.1 sec above 15 km/h  
 Vehicle Must stay in lane of 3.5m

STOP	INIT	LEFT	RIGHT	LEFT	RIGHT	ACTUAL	CORRECTED	MAX.	AVG.	MAX.	AVG.
#	SPD	FRONT	FRONT	REAR	REAR	DISTANCE	DISTANCE	PEDAL	PEDAL	DECEL	DECEL
	(kph)	(°C)	(°C)	(°C)	(°C)	(meter)	(meter)	(N)	(N)	(m/sec <sup>2</sup> )	(m/sec <sup>2</sup> )
1	159.58	81	83	56	50	112.4	113.0	551.86	382.76	14.72	7.78
2	160.05	93	98	56	48	116.7	116.6	472.18	324.97	17.99	5.52
3	159.08	94	97	56	48	112.8	114.1	469.70	391.34	15.58	8.71
4	158.81	91	97	53	48	113.6	115.3	483.41	406.26	15.58	9.12
5	158.75	89	97	57	48	114.0	115.8	512.68	380.57	14.33	7.20
6	160.21	88	97	57	48	113.3	113.0	473.22	388.52	14.69	9.02

STOP	DRIVER VEHICLE STOP COMMENTS				
#	(Wheel Lock-Up - Direction of Stop - Stay in Lane)				
1	-		NOX	SOUTH	YES
2	-		NOX	SOUTH	YES
3	-		NOX	SOUTH	YES
4	-		NOX	SOUTH	YES
5	-		NOX	SOUTH	YES
6	-		NOX	SOUTH	YES

Comments: Stop #2 - DAS recorded for 2 seconds after stop completion -  
 resulted in lower "average" recorded data.

DATA INDICATES COMPLIANCE: YES (X) NO ( )

Driver: JERRY INMAN Observer: NONE  
 Recorded Data Processed by: CHUCK JENKINS Date: 05/18/09  
 Approving Laboratory Official: RANDY LANDES Date: 05/19/09

Vehicle: 2009 TOYOTA MOTOR CO NHTSA NUMBER: C95104  
 Make: LEXUS  
 Model: ES 350  
 Body Style: 4 DOOR SEDAN  
 Front Cold Tire Pressure: 210 (Kpa)  
 Rear Cold Tire Pressure: 210 (Kpa)

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Date Tested: 05/08/09

## DATA SHEET 16 - ANTILOCK FUNCTIONAL FAILURE AT LLVW

Testing Conditions: INV DATA, Section 0040, 05/08/09, 13:33:39

Weather Conditions: 68°F Wind: 5 mph 154° Start Odo.: 513 End Odo.: 513

### Schedule:

Initial Brake Temperature: 65-100°C  
 Initial Speed 100 km/h to zero  
 6 stops with transmission in neutral

### Performance Requirements:

One Stop with:  
 Stopping Distance less than 85m  
 Pedal force between 65N and 500N  
 No Lock-Up allowed longer than 0.1 sec above 15 km/h  
 Vehicle Must stay in lane of 3.5m

STOP	INIT	LEFT	RIGHT	LEFT	RIGHT	ACTUAL	CORRECTED	MAX.	AVG.	MAX.	AVG.
#	SPD	FRONT	FRONT	REAR	REAR	DISTANCE	DISTANCE	PEDAL	PEDAL	DECEL	DECEL
	(kph)	(°C)	(°C)	(°C)	(°C)	(meter)	(meter)	(N)	(N)	(m/sec <sup>2</sup> )	(m/sec <sup>2</sup> )
1	99.08	69	74	56	53	58.2	59.3	168.90	148.11	9.70	6.77
2	100.40	90	94	63	59	55.6	55.1	264.16	113.16	10.10	6.98
3	99.50	84	91	55	52	60.8	61.4	174.28	125.93	9.36	6.49
4	100.35	78	86	52	49	62.2	61.8	146.38	125.64	10.02	5.80
5	101.09	89	98	60	57	57.7	56.5	201.83	132.22	9.75	6.94
6	99.79	79	87	53	49	61.0	61.2	146.49	128.76	9.23	6.51

STOP	DRIVER VEHICLE STOP COMMENTS				
#	(Wheel Lock-Up - Direction of Stop - Stay in Lane)				
1	-	NOX	SOUTH	YES	
2	-	NOX	SOUTH	YES	
3	-	NOX	SOUTH	YES	
4	-	NOX	SOUTH	YES	
5	-	NOX	SOUTH	YES	
6	-	NOX	SOUTH	YES	

Comments: See Appendix C.

How was the ABS failure induced: REMOVED HARNESS CONNECTOR FROM ABS ECU UNIT

Is brake system indicator lamp activated: YES (X) NO ( )

Vehicle equipped with ABS integral variable proportioning valve. Cannot separately fail. Data Sheet 17 not included.

DATA INDICATES COMPLIANCE: YES (X) NO ( )

Driver: JERRY INMAN Observer: NONE  
 Recorded Data Processed by: CHUCK JENKINS Date: 05/18/09  
 Approving Laboratory Official: RANDY LANDES Date: 05/19/09

Vehicle: 2009 TOYOTA MOTOR CO NHTSA NUMBER: C95104  
 Make: LEXUS  
 Model: ES 350  
 Body Style: 4 DOOR SEDAN  
 Front Cold Tire Pressure: 210 (Kpa)  
 Rear Cold Tire Pressure: 210 (Kpa)

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Date Tested: 05/11/09

## DATA SHEET 18 - HYDRAULIC CIRCUIT FAILURE #1 AT LLVW

Testing Conditions: INV DATA, Section 0050, 05/11/09, 08:47:08

Weather Conditions: 52°F Wind: 4 mph 338° Start Odo.: 517 End Odo.: 521

Method of simulating failure: Disconnected Brake Line Front Port @ M/C

System Portion Failed: LF & RR

### Schedule:

Initial Brake Temperature: 65-100°C  
 Initial Speed 100 km/h to zero  
 4 stops with transmission in neutral

### Performance Requirements:

One Stop with:  
 Stopping Distance less than 168m  
 Pedal force between 65N and 500N  
 No Lock-Up allowed longer than 0.1 sec above 15 km/h  
 Vehicle Must stay in lane of 3.5m

STOP	INIT	LEFT	RIGHT	LEFT	RIGHT		CORRECTED	MAX.	AVG.		
#	SPD	FRONT	FRONT	REAR	REAR	ACTUAL	DISTANCE	PEDAL	PEDAL	MAX.	AVG.
	(kph)	IBT	IBT	IBT	IBT	DISTANCE	(SAE 299)	FORCE	FORCE	DECEL	DECEL
		(°C)	(°C)	(°C)	(°C)	(meter)	(meter)	(N)	(N)	(m/sec <sup>2</sup> )	(m/sec <sup>2</sup> )
====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====
1	99.39	21	82	43	22	87.9	88.9	474.35	393.19	7.72	4.58
2	100.33	23	93	56	26	90.2	89.6	465.13	388.23	7.89	4.47
3	100.22	25	96	62	29	87.9	87.5	488.47	422.13	7.73	4.71
4	100.44	28	98	53	26	89.5	88.8	491.64	423.85	8.02	4.72

STOP DRIVER VEHICLE STOP COMMENTS  
 # (Wheel Lock-Up - Direction of Stop - Stay in Lane)

====	=====	=====	=====	=====	=====
1	-		NOX	SOUTH	YES
2	-		NOX	SOUTH	YES
3	-		NOX	SOUTH	YES
4	-		NOX	SOUTH	YES

Force Needed to Activate Brake Failure Lamp (N): N/A  
 Fluid Removed (mL) to Activate Brake Failure Lamp: 201

Is brake system indicator lamp activated: YES (X) NO ( )

DATA INDICATES COMPLIANCE: YES (X) NO ( )

Driver: JERRY INMAN Observer: NONE  
 Recorded Data Processed by: CHUCK JENKINS Date: 05/18/09  
 Approving Laboratory Official: RANDY LANDES Date: 05/19/09

Vehicle: 2009 TOYOTA MOTOR CO NHTSA NUMBER: C95104 Transportation Research Center, Inc.  
 Make: LEXUS 10820 State Route 347  
 Model: ES 350 East Liberty, Ohio 43319  
 Body Style: 4 DOOR SEDAN (937)666-2011 www.trcpg.com  
 Front Cold Tire Pressure: 210 (Kpa)  
 Rear Cold Tire Pressure: 210 (Kpa) Date Tested: 05/11/09

## DATA SHEET 19 - HYDRAULIC CIRCUIT FAILURE #2 AT LLVW

Testing Conditions: INV DATA, Section 0055, 05/11/09, 10:49:02

Weather Conditions: 57°F Wind: 9 mph 355° Start Odo.: 525 End Odo.: 528

Method of simulating failure: Disconnected Brake Line Rear Port @ M/C

System Portion Failed: RF & LR

### Schedule:

Initial Brake Temperature 65-100°C  
 Initial Speed 100 km/h to zero  
 4 stops with transmission in neutral

### Performance Requirements:

One Stop with:  
 Stopping Distance less than 168m  
 Pedal force between 65N and 500N  
 No Lock-Up allowed longer than 0.1 sec above 15 km/h  
 Vehicle Must stay in lane of 3.5m

		LEFT	RIGHT	LEFT	RIGHT		CORRECTED	MAX.	AVG.		
STOP	INIT	FRONT	FRONT	REAR	REAR	ACTUAL	DISTANCE	PEDAL	PEDAL	MAX.	AVG.
#	SPD	IBT	IBT	IBT	IBT	DISTANCE	(SAE 299)	FORCE	FORCE	DECEL	DECEL
	(kph)	(°C)	(°C)	(°C)	(°C)	(meter)	(meter)	(N)	(N)	(m/sec²)	(m/sec²)
=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====
1	100.36	82	32	24	62	91.3	90.6	489.40	407.60	7.09	4.05
2	100.31	95	30	24	62	92.1	91.5	491.41	431.08	8.84	4.45
3	100.64	96	31	23	56	93.3	92.1	486.85	395.92	8.92	4.36
4	100.25	96	30	22	52	92.0	91.6	512.36	416.70	9.73	4.46

STOP DRIVER VEHICLE STOP COMMENTS  
 # (Wheel Lock-Up - Direction of Stop - Stay in Lane)

1	-	NOX	SOUTH	YES
2	-	NOX	SOUTH	YES
3	-	NOX	SOUTH	YES
4	-	NOX	SOUTH	YES

Force Needed to Activate Brake Failure Lamp (N): N/A  
 Fluid Removed (mL) to Activate Brake Failure Lamp: 201

Is brake system indicator lamp activated: YES (X) NO ( )

DATA INDICATES COMPLIANCE: YES (X) NO ( )

Driver: JERRY INMAN Observer: NONE  
 Recorded Data Processed by: CHUCK JENKINS Date: 05/18/09  
 Approving Laboratory Official: RANDY LANDES Date: 05/19/09

Vehicle: 2009 TOYOTA MOTOR CO NHTSA NUMBER: C95104  
 Make: LEXUS  
 Model: ES 350  
 Body Style: 4 DOOR SEDAN  
 Front Cold Tire Pressure: 210 (Kpa)  
 Rear Cold Tire Pressure: 210 (Kpa)

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Date Tested: 05/11/09

## DATA SHEET 20 - HYDRAULIC CIRCUIT FAILURE #1 AT GVWR

Testing Conditions: INV DATA, Section 0060, 05/11/09, 14:33:37

Weather Conditions: 61°F Wind: 11 mph 342° Start Odo.: 537 End Odo.: 541

Method of simulating failure: Disconnected Brake Line Front Port @ M/C

System Portion Failed: LF & RR

### Schedule:

Initial Brake Temperature 65-100°C  
 Initial Speed 100 km/h to zero  
 6 stops with transmission in neutral

### Performance Requirements:

One Stop with:  
 Stopping Distance less than 168m  
 Pedal force between 65N and 500N  
 No Lock-Up allowed longer than 0.1 sec above 15 km/h  
 Vehicle Must stay in lane of 3.5m

STOP	INIT	LEFT	RIGHT	LEFT	RIGHT	ACTUAL	CORRECTED	MAX.	AVG.		
#	SPD	FRONT	FRONT	REAR	REAR	DISTANCE	DISTANCE	PEDAL	PEDAL	MAX.	AVG.
	(kph)	(°C)	(°C)	(°C)	(°C)	(meter)	(meter)	FORCE	FORCE	DECEL	DECEL
								(N)	(N)	(m/sec <sup>2</sup> )	(m/sec <sup>2</sup> )
1	100.60	32	89	54	29	101.8	100.6	463.15	389.44	8.35	4.19
2	100.40	32	96	51	28	100.7	100.0	467.61	406.55	7.10	4.05
3	100.00	34	97	46	29	102.4	102.4	503.10	433.78	7.26	3.92
4	100.57	35	97	47	29	103.1	102.0	483.45	427.19	6.94	3.72

STOP	DRIVER VEHICLE STOP COMMENTS			
#	(Wheel Lock-Up - Direction of Stop - Stay in Lane)			
1	-	NOX	SOUTH	YES
2	-	NOX	SOUTH	YES
3	-	NOX	SOUTH	YES
4	-	NOX	SOUTH	YES

Is brake system indicator lamp activated: YES (X) NO ( )

DATA INDICATES COMPLIANCE: YES (X) NO ( )

Driver: JERRY INMAN Observer: NONE  
 Recorded Data Processed by: CHUCK JENKINS Date: 05/18/09  
 Approving Laboratory Official: RANDY LANDES Date: 05/19/09

Vehicle: 2009 TOYOTA MOTOR CO NHTSA NUMBER: C95104  
 Make: LEXUS  
 Model: ES 350  
 Body Style: 4 DOOR SEDAN  
 Front Cold Tire Pressure: 210 (Kpa)  
 Rear Cold Tire Pressure: 210 (Kpa)

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Date Tested: 05/11/09

## DATA SHEET 21 - HYDRAULIC CIRCUIT FAILURE #2 AT GVWR

Testing Conditions: INV DATA, Section 0065, 05/11/09, 12:31:50

Weather Conditions: 59°F Wind: 7 mph 319° Start Odo.: 531 End Odo.: 534

Method of simulating failure: Disconnected Brake Line Rear Port @ M/C

System Portion Failed: LR & RF

### Schedule:

Initial Brake Temperature 65-100°C  
 Initial Speed 100 km/h to zero  
 4 stops with transmission in neutral

### Performance Requirements:

One Stop with:  
 Stopping Distance less than 168m  
 Pedal force between 65N and 500N  
 No Lock-Up allowed longer than 0.1 sec above 15 km/h  
 Vehicle Must stay in lane of 3.5m

STOP	INIT	LEFT	RIGHT	LEFT	RIGHT	ACTUAL	CORRECTED	MAX.	AVG.		
#	SPD	FRONT	FRONT	REAR	REAR	DISTANCE	DISTANCE	PEDAL	PEDAL	MAX.	AVG.
	(kph)	(°C)	(°C)	(°C)	(°C)	(meter)	(meter)	FORCE	FORCE	DECEL	DECEL
								(N)	(N)	(m/sec <sup>2</sup> )	(m/sec <sup>2</sup> )
1	99.79	72	28	23	48	108.4	108.9	495.37	417.04	6.90	3.83
2	98.57	92	29	24	54	106.3	109.4	510.17	422.39	6.73	3.76
3	100.18	97	32	26	59	108.2	107.8	475.90	399.59	6.48	3.81
4	100.94	95	33	26	57	106.7	104.7	497.96	416.29	6.67	3.76

STOP	DRIVER VEHICLE STOP COMMENTS			
#	(Wheel Lock-Up - Direction of Stop - Stay in Lane)			
1	-	NOX	SOUTH	YES
2	-	NOX	SOUTH	YES
3	-	NOX	SOUTH	YES
4	-	NOX	SOUTH	YES

Is brake system indicator lamp activated: YES (X) NO ( )

DATA INDICATES COMPLIANCE: YES (X) NO ( )

Driver: JERRY INMAN Observer: NONE  
 Recorded Data Processed by: CHUCK JENKINS Date: 05/18/09  
 Approving Laboratory Official: RANDY LANDES Date: 05/19/09

Vehicle: 2009 TOYOTA MOTOR CO NHTSA NUMBER: C95104 Transportation Research Center, Inc.  
 Make: LEXUS 10820 State Route 347  
 Model: ES 350 East Liberty, Ohio 43319  
 Body Style: 4 DOOR SEDAN (937)666-2011 www.trcpg.com  
 Front Cold Tire Pressure: 210 (Kpa)  
 Rear Cold Tire Pressure: 210 (Kpa) Date Tested: 05/12/09

## DATA SHEET 22 - ANTILOCK FUNCTIONAL FAILURE AT GVWR

Testing Conditions: INV DATA, Section 0070, 05/12/09, 09:30:07

Weather Conditions: 59°F Wind: 0 mph 220° Start Odo.: 548 End Odo.: 548

### Schedule:

Initial Brake Temperature 65-100°C  
 Initial Speed 100 km/h to zero  
 6 stops with transmission in neutral

### Performance Requirements:

One Stop with:  
 Stopping Distance less than 85m  
 Pedal force between 65N and 500N  
 No Lock-Up allowed longer than 0.1 sec above 15 km/h  
 Vehicle Must stay in lane of 3.5m

STOP	INIT	LEFT	RIGHT	LEFT	RIGHT	ACTUAL	CORRECTED	MAX.	AVG.	MAX.	AVG.
#	SPD	FRONT	FRONT	REAR	REAR	DISTANCE	DISTANCE	PEDAL	PEDAL	DECEL	DECEL
	(kph)	(°C)	(°C)	(°C)	(°C)	(meter)	(meter)	(N)	(N)	(m/sec <sup>2</sup> )	(m/sec <sup>2</sup> )
1	99.28	79	90	62	58	58.2	59.1	200.65	146.95	9.85	6.90
2	100.86	82	94	56	56	58.2	57.2	179.16	145.51	9.77	7.07
3	100.44	86	96	53	54	60.8	60.3	157.38	136.69	9.64	6.73
4	100.09	97	92	57	56	68.9	68.8	145.16	115.25	8.36	5.83
5	99.45	93	94	55	52	66.3	67.0	146.77	116.58	8.36	5.98
6	100.04	68	69	62	61	67.8	67.7	157.67	131.62	9.29	6.12

STOP	DRIVER VEHICLE STOP COMMENTS			
#	(Wheel Lock-Up - Direction of Stop - Stay in Lane)			
1	-	NOX	SOUTH	YES
2	-	NOX	SOUTH	YES
3	-	NOX	SOUTH	YES
4	-	NOX	SOUTH	YES
5	-	NOX	SOUTH	YES
6	-	NOX	SOUTH	YES

Comments: See Appendix C.

How was the ABS failure induced: REMOVED HARNESS CONNECTOR FROM ABS ECU UNIT

Is brake system indicator lamp activated: YES (X) NO ( )

Vehicle equipped with ABS integral variable proportioning valve. Cannot separately fail. Data Sheet 23 not included.

DATA INDICATES COMPLIANCE: YES (X) NO ( )

Driver: JERRY INMAN Observer: NONE  
 Recorded Data Processed by: CHUCK JENKINS Date: 05/18/09  
 Approving Laboratory Official: RANDY LANDES Date: 05/19/09

Vehicle: 2009 TOYOTA MOTOR CO NHTSA NUMBER: C95104  
 Make: LEXUS  
 Model: ES 350  
 Body Style: 4 DOOR SEDAN  
 Front Cold Tire Pressure: 210 (Kpa)  
 Rear Cold Tire Pressure: 210 (Kpa)

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Date Tested: 05/12/09

## DATA SHEET 24 - BRAKE POWER UNIT OR PWR ASSIST UNIT IN/OP AT GVWR

Testing Conditions: INV DATA, Section 0080, 05/12/09, 10:45:34

Weather Conditions: 59°F Wind: 3 mph 140° Start Odo.: 549 End Odo.: 553

Failure Simulation: Disconnect primary source of power.

Method of rendering inoperative: Removed Engine Vacuum Hose at Booster

### Schedule:

Initial Brake Temperature 65-100°C  
 Initial Speed 100 km/h to zero  
 6 stops with transmission in neutral

### Performance Requirements:

One Stop with:  
 Stopping Distance less than 168m  
 Pedal force between 65N and 500N  
 No Lock-Up allowed longer than 0.1 sec above 15 km/h  
 Vehicle Must stay in lane of 3.5m

STOP	INIT	LEFT	RIGHT	LEFT	RIGHT	ACTUAL	CORRECTED	MAX.	AVG.	MAX.	AVG.
#	SPD	IBT	FRONT	IBT	REAR	DISTANCE	(SAE 299)	PEDAL	PEDAL	DECEL	DECEL
	(kph)	(°C)	(°C)	(°C)	(°C)	(meter)	(meter)	(N)	(N)	(m/sec <sup>2</sup> )	(m/sec <sup>2</sup> )
1	100.11	68	69	49	46	139.3	139.0	549.01	482.10	4.12	2.78
2	101.59	92	98	64	61	155.2	150.4	499.16	465.74	3.86	2.62
3	99.74	88	97	57	54	150.7	151.5	493.34	463.83	4.21	2.89
4	100.82	87	96	54	54	145.5	143.2	498.64	476.45	4.32	2.90
5	100.05	89	98	56	52	144.0	143.9	494.20	473.46	4.19	2.80
6	100.28	87	97	57	51	143.8	143.0	513.16	471.44	4.50	3.03

STOP	DRIVER VEHICLE STOP COMMENTS			
#	(Wheel Lock-Up - Direction of Stop - Stay in Lane)			
1	-	NOX	SOUTH	YES
2	-	NOX	SOUTH	YES
3	-	NOX	SOUTH	YES
4	-	NOX	SOUTH	YES
5	-	NOX	SOUTH	YES
6	-	NOX	SOUTH	YES

Is the brake system indicator lamp activated: YES ( ) NO (X)

DATA INDICATES COMPLIANCE: YES (X) NO ( )

Driver: JERRY INMAN Observer: NONE  
 Recorded Data Processed by: CHUCK JENKINS Date: 05/18/09  
 Approving Laboratory Official: RANDY LANDES Date: 05/19/09

Vehicle: 2009 TOYOTA MOTOR CO NHTSA NUMBER: C95104 Transportation Research Center, Inc.  
 Make: LEXUS 10820 State Route 347  
 Model: ES 350 East Liberty, Ohio 43319  
 Body Style: 4 DOOR SEDAN (937) 666-2011 www.trcpg.com  
 Front Cold Tire Pressure: 210 (Kpa)  
 Rear Cold Tire Pressure: 210 (Kpa) Date Tested: 05/12/09

## DATA SHEET 25 - PARKING BRAKE AT GVWR

Testing Conditions: INV DATA, Section 0085, 05/12/09, 12:52:47  
 Parking brake: AUTOMATIC TR Non-service type: FOOT-OPERATED Service type: N/A  
 Weather Conditions: 61°F Wind: 6 mph 331° Start Odo.: 556 End Odo.: 556  
 Test Weight: Total: 2123kg Front: 1125kg Rear: 998kg

### Schedule:

Initial Brake Temperature <100°C or (Ambient temp.  
 if non-service brake type materials)  
 Loaded to GVWR with transmission in neutral  
 Drive onto 20% slope in forward and reverse directions.

### Performance Requirements:

Up to Three Applies in each direction:  
 Parking brake must hold the vehicle stationary  
 in both directions for 5 minutes each.  
 Pedal force: Hand control: <400 N  
 Foot control: <500 N

NOTE: For vehicles with parking brake systems not utilizing the  
 service brake friction elements, the friction elements of such systems  
 are to be burnished prior to parking brake tests according to the  
 manufacturer's published recommendation as furnished to the purchaser.  
 If no recommendations are furnished, test the system in an unburnished  
 condition. If recommendations are furnished, record method used.

	MAX	MAX	LEFT	RIGHT	AVG					
	SERVICE	P-BRAKE	REAR	REAR	REAR					
APPLY	FORCE	FORCE	IBT	IBT	IBT					
#	(N)	(N)	(°C)	(°C)	(°C)					
=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====
1	70.2	449.6	40	39	39.7	-	0 REAPPLY	UPHILL	HOLDS	20%
2	63.4	482.3	37	36	36.4	-	0 REAPPLY	DOWNHILL	HOLDS	20%

Is brake system indicator lamp activated: YES (X) NO ( )

DATA INDICATES COMPLIANCE: YES (X) NO ( )

Driver: JERRY INMAN Observer: NONE  
 Recorded Data Processed by: CHUCK JENKINS Date: 05/18/09  
 Approving Laboratory Official: RANDY LANDES Date: 05/19/09

Vehicle: 2009 TOYOTA MOTOR CO NHTSA NUMBER: C95104  
 Make: LEXUS  
 Model: ES 350  
 Body Style: 4 DOOR SEDAN  
 Front Cold Tire Pressure: 210 (Kpa)  
 Rear Cold Tire Pressure: 210 (Kpa)

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Date Tested: 05/12/09

## DATA SHEET 26 - HEATING SNUBS AT GVWR

Testing Conditions: INV DATA, Section 0090, 05/12/09, 15:33:54

### Schedule:

Conduct 15 snubs from 120 Km/h or 80% Vmax, whichever is slower, to 1/2 of initial speed.  
 Attain required decel in 1 second and maintain that decel.  
 Interval between snubs is 45 seconds and WOT to initial speed.

### Performance Requirements:

Initial IBT for first snub is 55-65°C  
 Maintain 3.0 m/s/s deceleration  
 Vehicle Must stay in lane of 3.5m

SNUB #	AVG. DRCEL (m/sec <sup>2</sup> )	Time Between Snubs (second)	AVG. PEDAL FORCE (N)	LEFT FRONT IBT (°C)	RIGHT FRONT IBT (°C)	LEFT REAR IBT (°C)	RIGHT REAR IBT (°C)	INIT SPD (kph)
1	3.99	--NA--	54.49	59	63	44	47	120.29
2	2.76	47	35.25	103	112	73	77	118.79
3	3.05	44	41.47	143	154	101	103	119.75
4	3.07	46	49.02	182	192	126	127	119.61
5	2.89	46	44.30	211	223	152	150	120.39
6	2.94	44	52.07	238	249	181	173	120.30
7	2.72	45	47.81	256	268	205	193	118.86
8	2.87	45	54.38	269	281	223	212	119.96
9	2.90	45	49.88	281	291	237	228	121.89
10	2.93	44	56.62	291	299	249	242	119.62
11	2.98	46	53.57	297	309	256	248	119.79
12	3.05	45	58.01	301	316	262	254	119.74
13	3.09	44	51.32	306	322	269	263	120.61
14	2.95	46	54.26	310	324	274	270	118.97
15	2.89	45	57.08	312	326	278	274	119.44

STOP #	DRIVER VEHICLE SNUB COMMENTS			
#	(Wheel Lock-Up - Direction of Stop - Stay in Lane)			
1	-	NOX	EAST	YES
2	-	NOX	SOUTHEAST	YES
3	-	NOX	SOUTH	YES
4	-	NOX	SOUTH	YES
5	-	NOX	SOUTH	YES
6	-	NOX	WEST	YES
7	-	NOX	WEST	YES
8	-	NOX	NORTH	YES
9	-	NOX	NORTH	YES
10	-	NOX	NORTH	YES
11	-	NOX	EAST	YES
12	-	NOX	EAST	YES
13	-	NOX	SOUTH	YES
14	-	NOX	SOUTH	YES
15	-	NOX	WEST	YES

DATA INDICATES COMPLIANCE: YES (X) NO ( )

Driver: JERRY INMAN      Observer: NONE  
 Recorded Data Processed by: CHUCK JENKINS      Date: 05/18/09  
 Approving Laboratory Official: RANDY LANDES      Date: 05/19/09

Vehicle: 2009 TOYOTA MOTOR CO NHTSA NUMBER: C95104  
 Make: LEXUS  
 Model: ES 350  
 Body Style: 4 DOOR SEDAN  
 Front Cold Tire Pressure: 210 (Kpa)  
 Rear Cold Tire Pressure: 210 (Kpa)

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Date Tested: 05/12/09

## DATA SHEET 27 - HOT PERFORMANCE AT GVWR

Testing Conditions: INV DATA, Section 0095, 05/12/09, 15:44:53

### Schedule:

Make 2 stops from 100 kph  
 Pedal Force: 1st stop is done with an average force less than the average recorded in the shortest GVWR Cold Effectiveness stop.  
 2nd stop is done with a force less than 500 N.  
 No Lock-Up allowed longer than 0.1 sec above 15 km/h.  
Distance Requirements are based on the following:  
 shortest stop in Data Sheet 11 is: 3  
 Initial speed of stop: 100.22 (kph)  
 Actual distance of stop: 47.8 (meter)  
 Average pedal force: 383.2 (N)

### Performance Requirements:

Stop Number 1 must be less than: 73.0 (meter)  
 In addition the stopping distance for at least one of the of the two hot stops must be less than: 89 (meter)

STOP	INIT	LEFT FRONT	RIGHT FRONT	LEFT REAR	RIGHT REAR	ACTUAL DISTANCE	CORRECTED DISTANCE (SAE 299)	MAX. PEDAL FORCE (N)	AVG. PEDAL FORCE (N)	MAX. DECEL (m/sec <sup>2</sup> )	AVG. DECEL (m/sec <sup>2</sup> )
#	(kph)	(°C)	(°C)	(°C)	(°C)	(meter)	(meter)				
1	100.07	328	343	287	282	59.2	59.1	401.95	288.93	10.16	6.65
2	99.01	351	367	293	287	53.5	54.5	485.93	411.57	12.98	7.07

STOP #	(Wheel Lock-Up - Direction of Stop - Stay in Lane)
1	- NOX WEST YES
2	- NOX NORTHWEST YES

DATA INDICATES COMPLIANCE: YES (X) NO ( )

Driver: JERRY INMAN Observer: NONE  
 Recorded Data Processed by: CHUCK JENKINS Date: 05/18/09  
 Approving Laboratory Official: RANDY LANDES Date: 05/19/09

Vehicle: 2009 TOYOTA MOTOR CO NHTSA NUMBER: C95104  
 Make: LEXUS  
 Model: ES 350  
 Body Style: 4 DOOR SEDAN  
 Front Cold Tire Pressure: 210 (Kpa)  
 Rear Cold Tire Pressure: 210 (Kpa)

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Date Tested: 05/12/09

## DATA SHEET 28 - BRAKE COOLING STOPS AT GVWR

Testing Conditions: INV DATA, Section 0100, 05/12/09, 15:47:21

### Schedule:

Initial Brake Temperature:  
 Achieved on completing Hot Performance  
 Initial Speed 50 km/h to zero  
 4 stops with transmission in gear

### Performance Requirements:

Constant Decel rate: 3.0 m/s/s  
 Pedal force adjusted as necessary  
 No Lock-Up allowed longer than 0.1 sec above 15 km/h  
 Vehicle Must stay in lane of 3.5m

STOP #	INIT SPD (kph)	AVG. DECEL (m/sec <sup>2</sup> )	AVG. PEDAL FORCE (N)	LEFT FRONT IBT (°C)	RIGHT FRONT IBT (°C)	LEFT REAR IBT (°C)	RIGHT REAR IBT (°C)
1	49.65	2.61	47.87	314	337	265	255
2	50.09	2.83	44.24	249	272	223	218
3	49.23	3.02	48.33	203	219	191	189
4	50.70	3.07	39.92	165	180	163	166

STOP #	DRIVER VEHICLE STOP COMMENTS (Wheel Lock up - Direction of Stop - Stay in Lane)			
1	-	NOX	NORTH	YES
2	-	NOX	NORTH	YES
3	-	NOX	EAST	YES
4	-	NOX	SOUTH	YES

DATA INDICATES COMPLIANCE: YES (X) NO ( )

Driver: JERRY INMAN	Observer: NONE
Recorded Data Processed by: CHUCK JENKINS	Date: 05/18/09
Approving Laboratory Official: RANDY LANDES	Date: 05/19/09

Vehicle: 2009 TOYOTA MOTOR CO NHTSA NUMBER: C95104  
 Make: LEXUS  
 Model: ES 350  
 Body Style: 4 DOOR SEDAN  
 Front Cold Tire Pressure: 210 (Kpa)  
 Rear Cold Tire Pressure: 210 (Kpa)

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Date Tested: 05/12/09

## DATA SHEET 29 - RECOVERY PERFORMANCE AT GVWR

Testing Conditions: INV DATA, Section 0105, 05/12/09, 15:53:44

Weather Conditions: 64°F Wind: 2 mph 344° Start Odo.: 560 End Odo.: 579

### Schedule:

Make 2 stops from 100 kph

Pedal Force: Both stops are performed with an average force less than the average recorded in the shortest GVWR Cold Effectiveness stop.

### Performance Requirements:

One of the two stops must be within the following limits:

Upper limit of corrected stopping distance: 64.0 (meter)  
 Lower limit of corrected stopping distance: 35.2 (meter)

No Lock-Up allowed longer than 0.1 sec above 15 km/h.

### Distance Requirements are based on the following:

shortest stop in Data Sheet 11 is: Stop3  
 Initial speed of stop: 100.22 (kph)  
 Actual distance of stop: 47.8 (meter)  
 Average pedal force: 383.2 (N)

STOP #	INIT SPD (kph)	LEFT FRONT IBT (°C)	RIGHT FRONT IBT (°C)	LEFT REAR IBT (°C)	RIGHT REAR IBT (°C)	ACTUAL DISTANCE (meter)	CORRECTED DISTANCE (SAE 299) (meter)	MAX. PEDAL FORCE (N)	AVG. PEDAL FORCE (N)	MAX. DECEL (m/sec²)	AVG. DECEL (m/sec²)
1	99.97	162	176	161	164	50.1	50.2	405.00	322.17	14.06	7.75
2	101.25	189	208	177	182	49.2	48.0	406.56	280.06	12.83	6.32

STOP #	DRIVER VEHICLE STOP COMMENTS (Wheel Lock-Up - Direction of Stop - Stay in Lane)			
1	-	NOX	SOUTH	YES
2	-	NOX	SOUTH	YES

DATA INDICATES COMPLIANCE: YES (X) NO ( )

Driver: JERRY INMAN Observer: NONE  
 Recorded Data Processed by: CHUCK JENKINS Date: 05/18/09  
 Approving Laboratory Official: RANDY LANDES Date: 05/19/09

**DATA SHEET 30 (Part 1 of 5)**  
**6.0 Test Completion Inspection (7.17)**

VEHICLE: 2009 Lexus ES 350

NHTSA NO.: C95104

ODO.: 587 mi.

DATE: 05/15/09

**System Integrity (S5.6)**

Each vehicle shall meet the complete performance requirements of this standard without:

(a) Detachment or fracture of any component of the braking system such as brake springs and brake shoes or disc pad facings, other than minor cracks, that do not impair attachment of the friction facings. All mechanical components of the braking system shall be intact and functional. Friction facing tearout (complete detachment of lining) shall not exceed 10 percent of the lining on any single frictional element.

(b) Any visible brake fluid or lubricant on the friction surface of the brake or leakage at the master cylinder or brake power unit reservoir cover, seal, and filler openings.

Friction Material Condition: Primary/Inner		Friction Material Condition: Secondary/Outer	
LF	Normal Appearance & Color	LF	Normal Appearance & Color
RF	Normal Appearance & Color	RF	Normal Appearance & Color
LR	Normal Appearance & Color	LF	Normal Appearance & Color
RR	Normal Appearance & Color	RR	Normal Appearance & Color
Drum (or Rotor) Condition:		Brake Fluid/Lubricant Inside Brakes:	
LF	Normal Appearance & Color	LF	None
RF	Normal Appearance & Color	RF	None
LR	Normal Appearance & Color	LR	None
RR	Normal Appearance & Color	RR	None
Hydraulic Component Condition:		Mechanical Component Condition:	
LF	Good	Brk/Pedal	Good
RF	Good	Power Brk	Good
LR	Good	Stop/Lamp	Good
RR	Good	Linkage	Good
M/Cyl	Good	Other	NA

COMPLIANCE: Yes X No     

Comments: None.

Technician: Jerry Inman

**DATA SHEET 30 (Part 2 of 5)**  
**TEST COMPLETION INSPECTION (S7.17)**

VEHICLE: 2009 Lexus ES 350; NHTSA NO.: C95104; GVWR: 2123 kg  
 MASTER CYLINDER RESERVOIR:

DATE	05/14/09	Requirements	Pass	Fail
<b>Reservoir Compartments (S5.4.1)</b>				
(1) Does master cylinder have a reservoir compartment for each brake subsystem?	<u>Yes</u>	Master cylinder shall have a reservoir compartment for each subsystem.	X	
	No			
(2) Does loss of fluid in one compartment result in complete loss from another compartment?	Yes	Loss of fluid from one compartment shall not cause complete loss from another compartment.	X	
	<u>No</u>			
<b>Reservoir Capacity (S5.4.2)</b>				
Shall conform to requirements (1) or (2), state units:				
(1) For reservoirs having completely separate compartments for each subsystem (two separate, independent reservoirs):				
Subsystem 1 Subsystem reservoir capacity		Each compartment (reservoir) shall have a minimum capacity equivalent to the fluid displacement resulting when all wheel cylinders or caliper pistons serviced by that independent compartment/reservoir moves from a new lining, fully retracted position to a fully worn, properly adjusted, fully applied position.  <b>(Use Data Sheet 31 and Appendix 1A)</b>	NA	NA
Subsystem 1 Fluid displaced from new to worn lining				
Subsystem 2 Subsystem reservoir capacity			NA	NA
Subsystem 2 Fluid displaced from new to worn lining				
2) For reservoirs utilizing a portion of the reservoir for a common supply to two or more subsystems:				
<b>Total</b> minimum capacity for the entire master cylinder reservoir (includes individual compartment reservoirs)	329 ml	Shall have total minimum capacity for entire reservoir for displacement resulting from all subsystem wheel cylinders or caliper positions moving from new lining to full worn condition as above.	X	
Fluid displaced from new to worn linings (ALL linings)	90.2 ml*			
*Value calculated from Data Sheet 31				

Comments: \*See Appendix C.

Technician: Jerry Inman

**DATA SHEET 30 (Part 3 of 5)**  
**TEST COMPLETION INSPECTION (\$7.18)**

VEHICLE: 2009 Lexus ES 350; NHTSA NO.: C95104; GVWR: 2123 kg

**MASTER CYLINDER RESERVOIR:**

DATE	05/14/09	Requirements	Pass	Fail
Master Cylinder Piston Displacement(\$5.4.2) [If Common Reservoir Supply - continued from previous page]				
Fluid displaced by three strokes of master cylinder piston for Subsystem No. 1.	29.0 ml	Individual partial compartments of reservoir shall <b>each</b> have a minimum of fluid equal to at least the volume displaced by the master cylinder piston servicing the subsystem during a <u>full stroke</u> of the piston.  <b>NOTE:</b> Procedure uses three strokes to ensure an accurate measurement.		
Fluid displaced by three strokes of master cylinder piston for Secondary (Subsystem No. 2)	29.0 ml			
Fluid displaced per stroke, Subsystem No. 1.	9.7 ml			
Fluid displaced per stroke, Subsystem No. 2.	9.7 ml			
Fluid available in partial compartment Subsystem No. 1	37.0 ml		X	
Fluid available in partial compartment Subsystem No. 2	38.0 ml		X	
<b>Brake Power Unit Reservoir (\$5.4.2)</b>				
Volume displaced in charging system piston or accumulator to normal operating pressure plus wheel cylinder or caliper piston displacement.		Shall have a capacity at least equal to fluid displacement required to charge the system pistons on accumulators to normal operating pressure <u>plus</u> displacement when wheel cylinders or caliper pistons move from new lining to full worn condition as above.	NA	
<b>Reservoir Labeling (\$5.4.3)</b>				
Exact copy of reservoir label: On top of master cylinder reservoir: <u>WARNING</u> <u>CLEAN FILLER CAP BEFORE REMOVING</u> <u>USE ONLY DOT3 FLUID FROM A SEALED</u> <u>CONTAINER.</u>		Label shall read: "Warning, clean filler cap before removing; use only * fluid from a sealed container". * Fluid type specified in 49 CFR 571.116	X	
Measure letter height	3.2 mm	Letters shall be at least 3.2 mm/ 0.125" high	X	
Describe label attachment method and location. <u>Embossed on top of the master cylinder</u> <u>reservoir filler cap.</u>		Lettering shall be permanently affixed, engraved or embossed and located so as to be visible by direct view either on or within 100 mm/3.94 inches of the brake fluid reservoir filler plug or cap.	X	
Does the lettering contrast with the background?	Yes	If label is not engraved or embossed, letters shall be of a color that contrasts with the background	NA	
	<u>No</u>			

Comments: None.

Technician: Jerry Inman

**DATA SHEET 30 (Part 4 of 5)**  
**TEST COMPLETION INSPECTION (S7.18)**

VEHICLE: 2009 Lexus ES 350; NHTSA NO.: C95104; DATE: 05/14/09  
 BRAKE SYSTEM WARNING INDICATOR (S5.5)

CONDITION	ANSWER	REQUIREMENTS	PASS	FAIL
Brake Systems Indicator Lamp <u>Function Check</u> (S5.5.2) (Bulb and systems check)				
Describe location of brake indicator lamp: <u>Approximate mid-line, extreme left edge of the instrument cluster.</u>	NA	Shall be in front, and in clear view, of driver.	X	
Does lamp light with ignition (start) switch at ON/RUN?	Yes	Automatic activation when ignition switch is "on" when engine <b>not running</b> , or ignition between "on" and "start" if is manufacturer check position- OR -single manual action by driver	X	
Does lamp light with ignition between ON and Start?	Yes			
Brake check description in owner's manual?	Yes	Manufacturer shall explain the brake check function test procedure in the owner's manual.	X	
<b>Brake System Warning Indicator ACTIVATION (S5.5.1) DURATION (S5.5.3) FUNCTION (S5.5.4)</b>				
CONDITION	Light ON?	REQUIREMENT	PASS	FAIL
A. In event of hydraulic leak (1) On or before appearance of pressure differential of 218 psi (split system)	NA	When ignition (Start) switch is <b>ON</b> , lamp must light whenever (A), (B), (C), or (D) occurs. In addition, if service brake system is not a split system, audible warning must be activated when any condition in (A) exists. Visual warning indicator for non-split systems must be flashing.	X	
(2) If any reservoir falls below either "safe" level or 25% of capacity, whichever is greater.  Values: <b>128 ml</b> or cc (above "min" mark).	Yes			
(3) On or before supply pressure to brake power unit falls to 50%	NA			
B. Electrical functional failure in an antilock or variable brake proportioning system.	Yes		X	
C. Application of the parking brake.	Yes			
D. Brake lining wear-out if optical warning.	NA			
E. For a vehicle with <u>electrically-actuated service brakes</u> , failure of the source of electric power to the brakes or diminution of state of charge of the batteries.	NA			
F. For a vehicle with <u>electric transmission of the service brake control signal</u> , failure to a brake control circuit.	NA			
G. For an EV with RBS that is part of the service brake system failure of RBS.	NA			
<b>Must have Audible alarm</b> if <u>not split system</u> and a condition in (a) above exists?	NA			
If condition (A) (2) above does not exist, then fluid reservoir must be <b>transparent</b> for fluid check without the need for reservoir to be opened? (S5.4.4)	NA			
Indicator lamps remain activated as long as condition exists - ignition "on", and engine on or off? _____ (S5.5.3 DURATION))	Yes			
Visual warning – continuous or flashing? Audible warning –continuous or flashing?	Yes-Cont. NA			

Comments: None.

Technician: Jerry Inman

**DATA SHEET 30 (Part 5 of 5)**  
**TEST COMPLETION INSPECTION (\$7.18)**

VEHICLE: 2009 Lexus ES 350; NHTSA NO.: C95104; DATE: 05/14/09

**BRAKE SYSTEM WARNING INDICATOR LABELING (\$5.5.5)**

CONDITION AND REQUIREMENT	ANSWER NOTE: Standard requires that the answer to questions be YES	PASS	FAIL
Are visual indicators legible to driver in daylight and nighttime conditions when activated?	Yes	X	
Are visual indicator words 3.2 mm (.125") high minimum? Record Height: "Brake" – <u>3.2 mm</u> ; "ABS" – <u>3.2 mm</u> .	Yes	X	
Visual indicator words and background contrasting colors, one of which is red. Record colors <u>Letters – Red, Lens – Black</u>	Yes	X	
If split system, is there one brake indicator? If yes, does it say the word "Brake"?	Yes	X	
If not split system; is there a separate indicator for loss of fluid or fluid pressure? Does this indicator say "Stop-Brake Failure"? Are the letters block and not less than 6.4 mm (.25") in height? Record letter height _____	NA		
If separate indicator for: 1. Low brake fluid per S5.5.1(a)(1), does indicator say "Brake Fluid"? NOTE: not required for mineral oil system Record wording: _____ 2. Gross pressure loss per S5.5.1(a)(2), does indicator say "Brake Pressure"? Record wording _____ 3. Electrical functional failure in antilock or variable proportioning system per S5.5.1(b), letters and background contrasting colors one of which is yellow? Record colors <u>Lens – Black, Letters – Yellow</u> . Does indicator say "Antilock" or "ABS" or "Brake Proportioning"? Record wording: <u>"ABS"</u> . 4. Parking brake per S5.5.1(c), does indicator say "Park" or "Parking Brake"? Record wording: _____ 5. Brake lining wear-out per S5.5.1(d), does indicator say "Brake Wear"? Record wording – _____.  6. If separate indicator for RBS, the letters and background shall be of contrasting colors, one of which is yellow. The indicator shall be labeled "RBS". RBS failure in a system which is part of the service brake system may also be indicated by a yellow lamp that also indicates "ABS" failure and displays the symbol "ABS/RBS." Record wording: _____  7. For any other function? If yes, Record _____ NA	NA  NA  Yes  Yes  NA  NA  NA	X	

DATA INDICATES COMPLIANCE: YES X NO \_\_\_\_\_

Comments: None.

Technician: Jerry Inman

# DATA SHEET 31 (Part 1 of 2)

## CALCULATION OF MINIMUM RESERVOIR VOLUME REQUIREMENTS

VEHICLE: 2009 Lexus ES 350; NHTSA NO.: C95104; DATE: 05/15/09

BRAKE		LINING		
LOCATION	TYPE	DESCRIPTION	MINIMUM THICKNESS	THICKNESS TO FULLY WORN (1) mm*
Left Front	Drum	Leading	Pre-test 11.48 mm	6.5
		Primary	Post Test 10.79 mm	
		Inboard X	Δ 0.69 mm	
	Disc X	Trailing	Pre-test 11.48 mm	6.5
		Secondary	Post Test 10.77 mm	
		Outboard X	Δ 0.71 mm	
LINING CLEARANCE:	Diametrical (2): N/A	Inboard: 0 mm.	Outboard: 0 mm.	
WHEEL CYLINDER DIAMETER (3): N/A		CALIPER PISTON DIAMETER (3): 63.42 mm (x1 piston).		
SHOE CAGE DIAMETER (4) <u>N/A</u> ; CENTER POINT OF BRAKE ASSY TO CENTER POINT OF W.C. <u>N/A</u>				
Right Rear	Drum	Leading	Pre-test 10.28 mm	6.0
		Primary	Post Test 10.13 mm	
		Inboard X	Δ 0.15 mm	
	Disc X	Trailing	Pre-test 10.38 mm	6.0
		Secondary	Post Test 10.08 mm	
		Outboard X	Δ 0.30 mm	
LINING CLEARANCE:	Diametrical (2) N/A mm	Inboard – 0 mm	Outboard – 0 mm	
WHEEL CYLINDER DIAMETER (3): N/A		CALIPER PISTON DIAMETER (3): 38.04 mm (x1 piston).		
SHOE CAGE DIAMETER (4): N/A		CENTER POINT OF BRAKE ASSY TO CENTER PT. OF W.C.: N/A		
CIRCUIT #1 CONSISTS OF:	LF - X	LR	RF	RR - X
CIRCUIT #2 CONSISTS OF:	LF	LR - X	RF - X	RR
(1) MFRS. RECOMMENDATIONS – FRONT: 6.5 mm & REAR: 6 mm.				
(2) REAR – 0 mm. FRONT – 0 mm.				
(2) DRUM BRAKES, MEASURED AT HORIZONTAL CENTERLINE: NA.				
(3) MFRS. DATA: FRONT – 63.5 mm, 1 piston; REAR – 38.1 mm, 1 piston.				
(4) RESET POSITION: NA.				

Comments: Manufacturer's new total lining thickness: Front – 12.0 mm, Rear – 10.5 mm.

Technician: Jerry Inman

**DATA SHEET 31 – SECTION CONTINUED (Part 2 of 2)**Vehicle: 2009 Lexus ES 350;NHTSA No.: C95104;Date: 05/20/09**Procedure and Example for Determining Master Cylinder Volume Requirement**

The procedure followed for determining the minimum volume requirements is outlined in the example shown below. The required data is taken from the previous page, both measured and manufacturer's data.

**DISC BRAKES**

Volume Required,  $V_r = (\Delta t_i + t_{ic} + \Delta t_o + t_{oc}) \times [\pi (D^2)]/4$ , where –

$V_r$  = Volume required per wheel  
 $\Delta t$  = Change in thickness (average)  
*i* = Inboard  
*o* = Outboard  
*D* = Caliper cylinder diameter  
*c* = Average clearance

Using the above equations, the volume requirements for Subsystem No. 1 (LF/RR) and Subsystem No. 2 (RF/ LR) were calculated utilizing measured and manufacturer's provided data to create the greatest displacement, as shown below:

$$\begin{aligned}
 \text{Disc Brake: } V_r &= (\Delta t_i + t_{ic} + \Delta t_o + t_{oc}) \times \frac{\pi D^2}{4} \\
 \text{(Front)} & \\
 \Delta t_i &= 5.5 \text{ mm} \\
 \Delta t_o &= 5.5 \text{ mm} \\
 t_{ic} + t_{oc} &= 0 \text{ mm} \\
 D &= 63.5 \text{ mm} \\
 V_r &= (5.5 + 0 + 5.5 + 0) \frac{\pi (63.5)^2}{4} \\
 &= 11 (3166.92) \\
 &= 34836.1 \text{ mm}^3 = 34.8 \text{ ml (x1 Piston)} = 34.8 \text{ ml}
 \end{aligned}$$

$$\begin{aligned}
 \text{Disc Brake: } V_r &= (\Delta t_i + t_{ic} + \Delta t_o + t_{oc}) \times \frac{\pi D^2}{4} \\
 \text{(Rear)} & \\
 \Delta t_i &= 4.5 \text{ mm} \\
 \Delta t_o &= 4.5 \text{ mm} \\
 t_{ic} + t_{oc} &= 0 \text{ mm} \\
 D &= 38.1 \text{ mm} \\
 V_r &= (4.5 + 0 + 4.5 + 0) \frac{\pi (38.1)^2}{4} \\
 &= 9 (1140.09) \\
 &= 10260.8 \text{ mm}^3 = 10.3 \text{ ml (x1 Piston)} = 10.3 \text{ ml}
 \end{aligned}$$

For System 1 (LF & RR)

$$\begin{aligned}
 V_{r1} &= 34836.1 \text{ mm}^3 + 10260.8 \text{ mm}^3 = 45096.9 \text{ mm}^3 \\
 V_{r1} &= 45096.9 \text{ mm}^3 = (45.1 \text{ ml})
 \end{aligned}$$

For System 2 (RF & LR)

$$\begin{aligned}
 V_{r2} &= V_{r1} \\
 V_{r2} &= 45096.9 \text{ mm}^3 = (45.1 \text{ ml})
 \end{aligned}$$

$$\text{TOTAL VOLUME REQUIRED} = V_t = V_{r1} + V_{r2} = 45.1 + 45.1 = 90.2 \text{ ml}^*$$

## Section 6.0

### Photographs

2009 Lexus ES 350,  
4-Dr. Sedan  
NHTSA No. C95104  
May 2009



Left Front 3/4 View

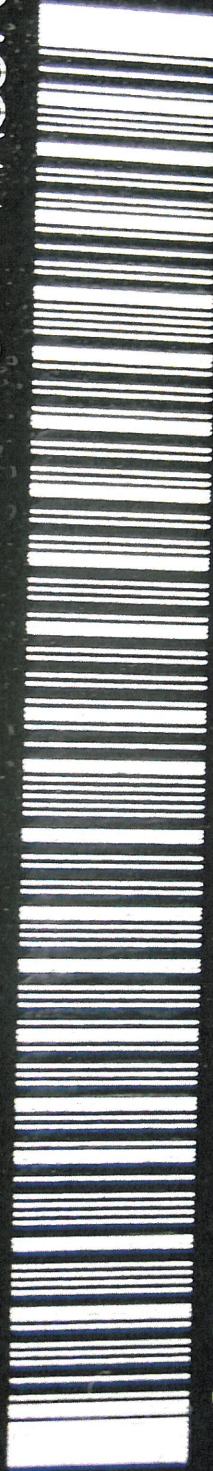


2009 Lexus ES 350,  
4-Dr. Sedan  
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May 2009

Right Rear 3/4 View

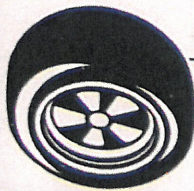
2009 Lexus ES 350,  
4-Dr. Sedan  
NHTSA No. C95104  
May 2009

MFD. BY: TOYOTA MOTOR CORPORATION 10/08  
GVWR 4680LB GAWR FR 2668LB RR 2359LB  
THIS VEHICLE CONFORMS TO ALL APPLICABLE  
FEDERAL MOTOR VEHICLE SAFETY BUMPER AND  
THEFT PREVENTION STANDARDS IN EFFECT ON  
THE DATE OF MANUFACTURE SHOWN ABOVE. CAR  
JTHBJ46GX92295416



C/TR: 1G0/LA25 GSV40L-BETGKA  
A/TM: -01A/U660E MADE IN JAPAN 122 A

2009 Lexus ES 350,  
4-Dr. Sedan  
NHTSA No. C95104  
May 2009



**TIRE AND LOADING INFORMATION**

SEATING CAPACITY: TOTAL 5  
FRONT 2: REAR 3

The combined weight of occupants  
and cargo should never exceed 410 kg or 900 lbs.

TIRE	SIZE	COLD TIRE PRESSURE
FRONT	P215/55R17	210kPa, 30PSI
REAR	P215/55R17	210kPa, 30PSI
SPARE	P215/55R17	210kPa, 30PSI

**SEE OWNER'S MANUAL FOR  
ADDITIONAL INFORMATION**

**INFORMATION SUR LES PNEUS ET LE CHARGEMENT**

NOMBRE DE PLACES ASSISES : TOTAL 5  
AVANT 2: ARRIÈRE 3

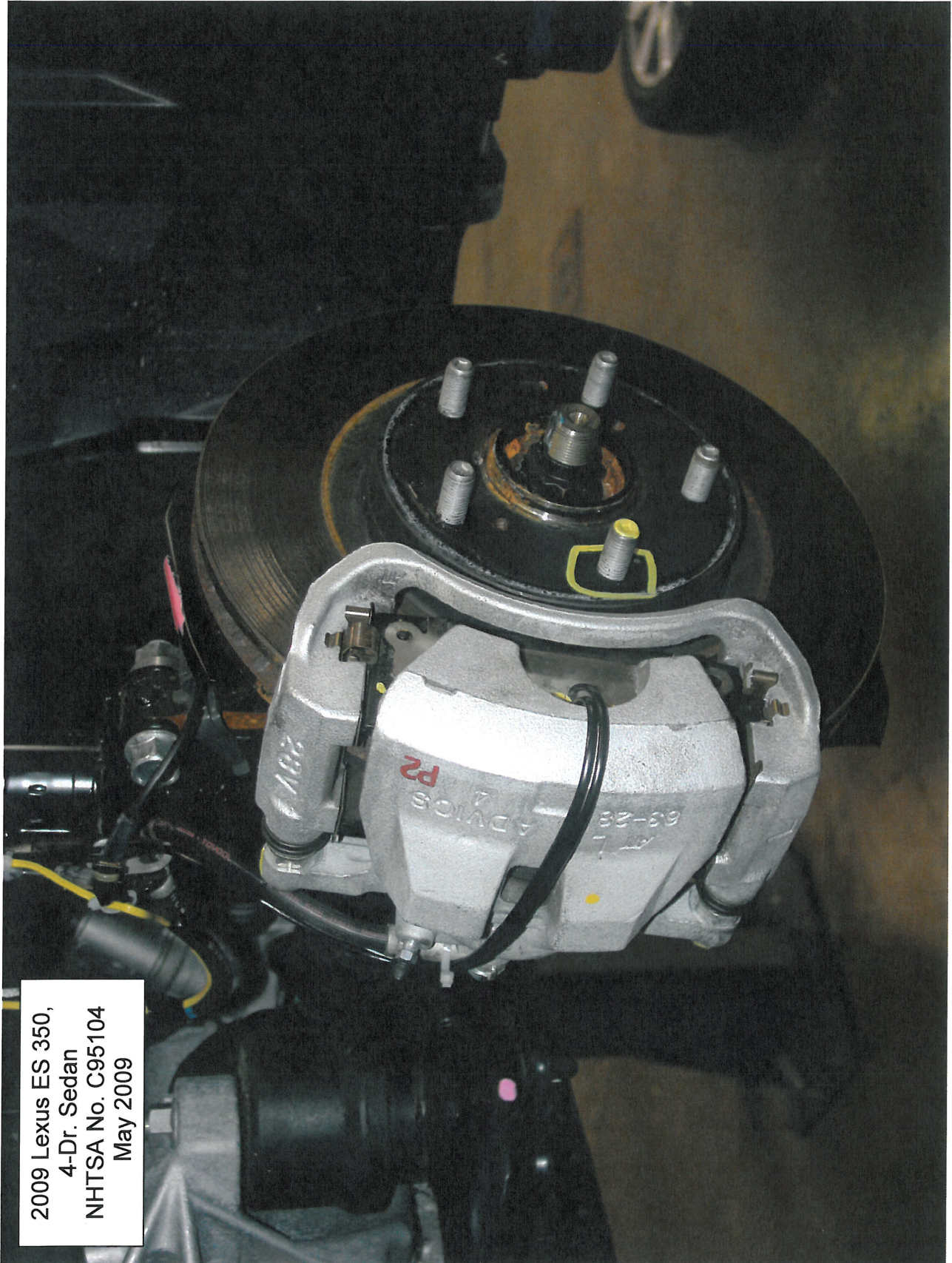
Le poids total des occupants et du chargement ne  
doit jamais être supérieur à 410 kg ou 900 lb.

PNEUS	DIMENSION	PRESSION DE GONFLAGE À FROID
AVANT	P215/55R17	210kPa, 30PSI
ARRIÈRE	P215/55R17	210kPa, 30PSI
SECOURS	P215/55R17	210kPa, 30PSI

**POUR DE PLUS AMPLES INFORMATIONS,  
VOIR LE MANUEL DU PROPRIÉTAIRE**

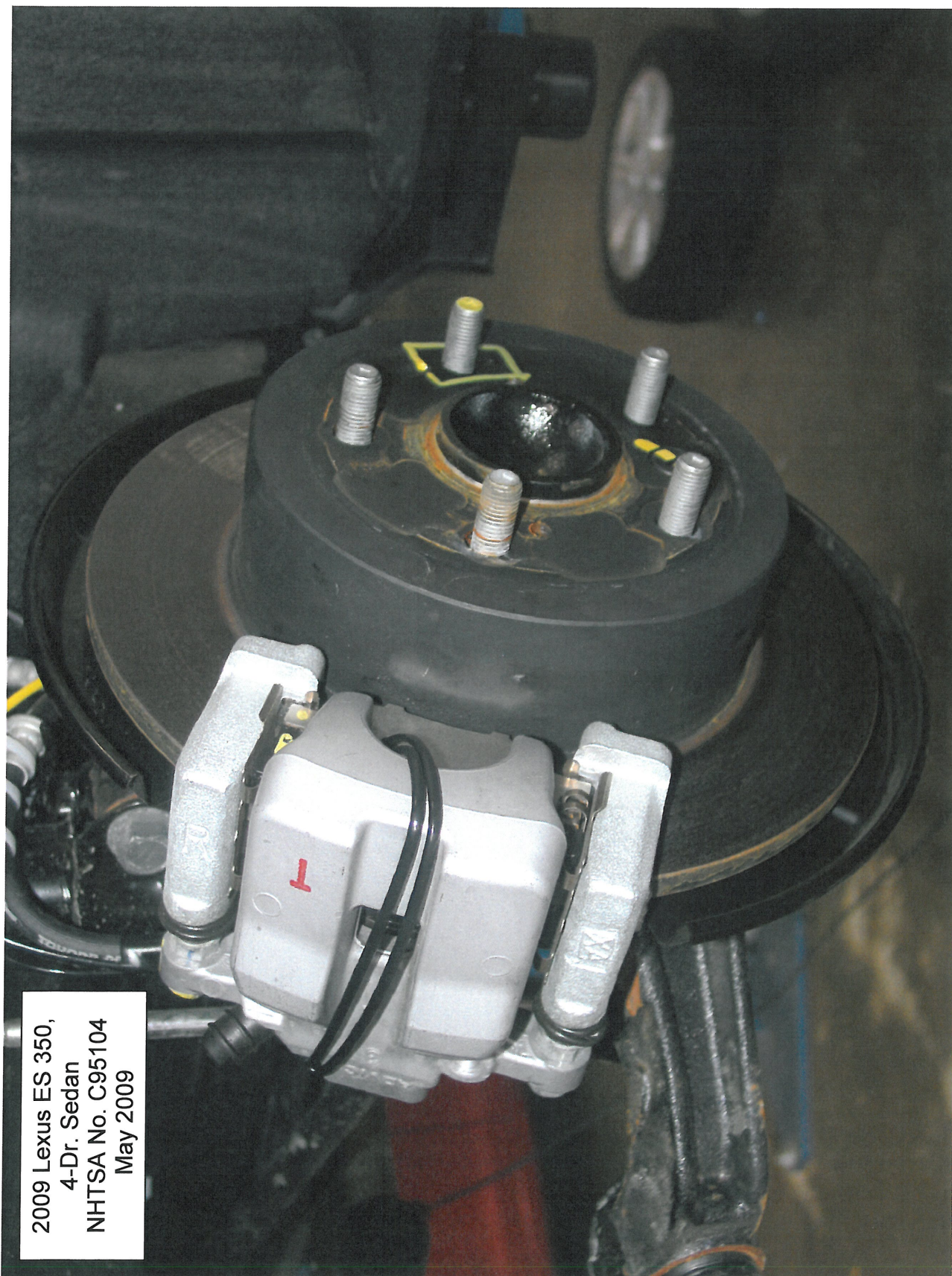
33632 9

2009 Lexus ES 350,  
4-Dr. Sedan  
NHTSA No. C95104  
May 2009



Left Front Thermocouple Installation

2009 Lexus ES 350,  
4-Dr. Sedan  
NHTSA No. C95104  
May 2009



Right Rear Thermocouple Installation

2009 Lexus ES 350,  
4-Dr. Sedan  
NHTSA No. C95104  
May 2009



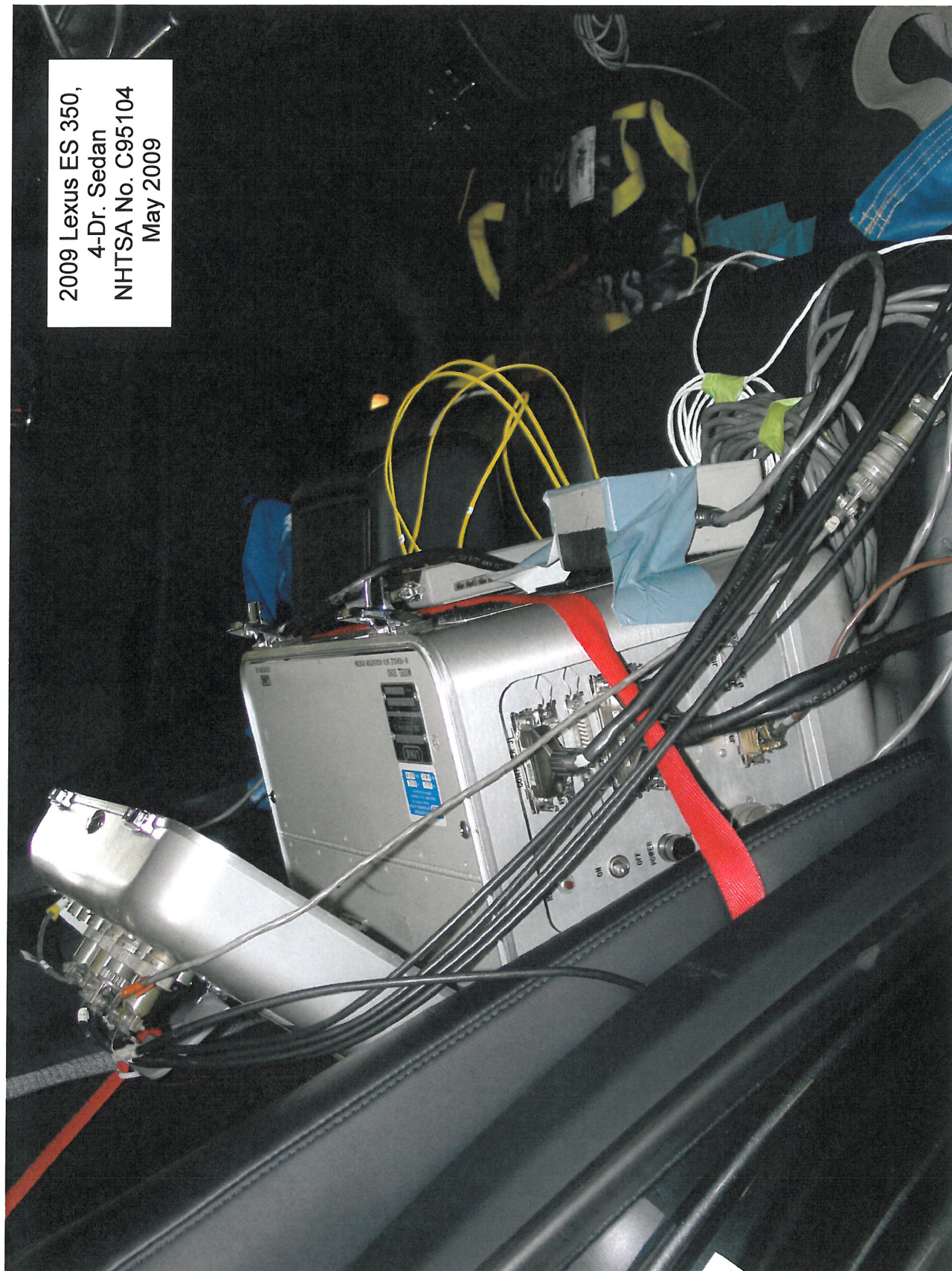
Test Instrumentation in Vehicle

2009 Lexus ES 350,  
4-Dr. Sedan  
NHTSA No. C95104  
May 2009



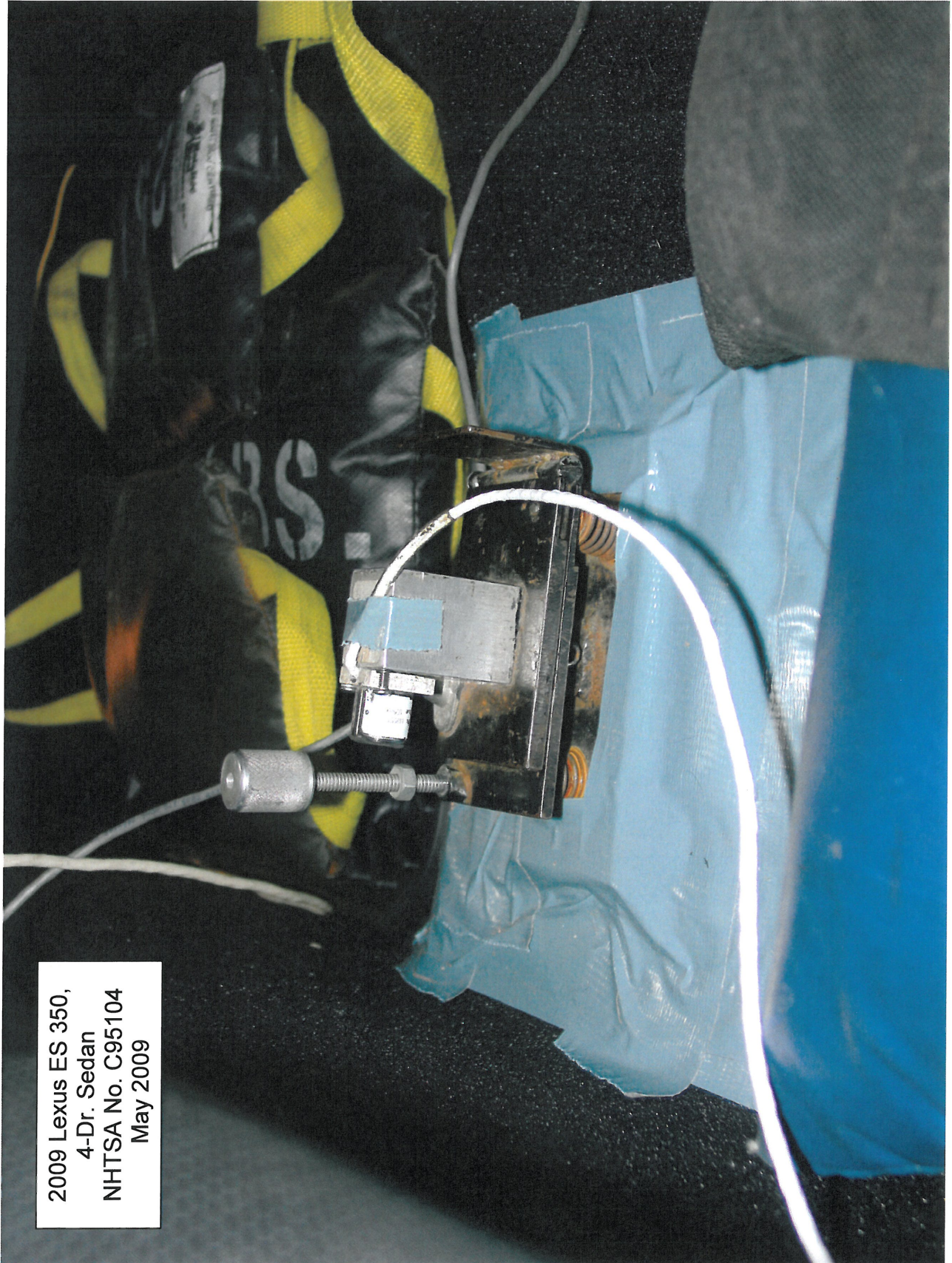
Test Instrumentation in Vehicle

2009 Lexus ES 350,  
4-Dr. Sedan  
NHTSA No. C95104  
May 2009

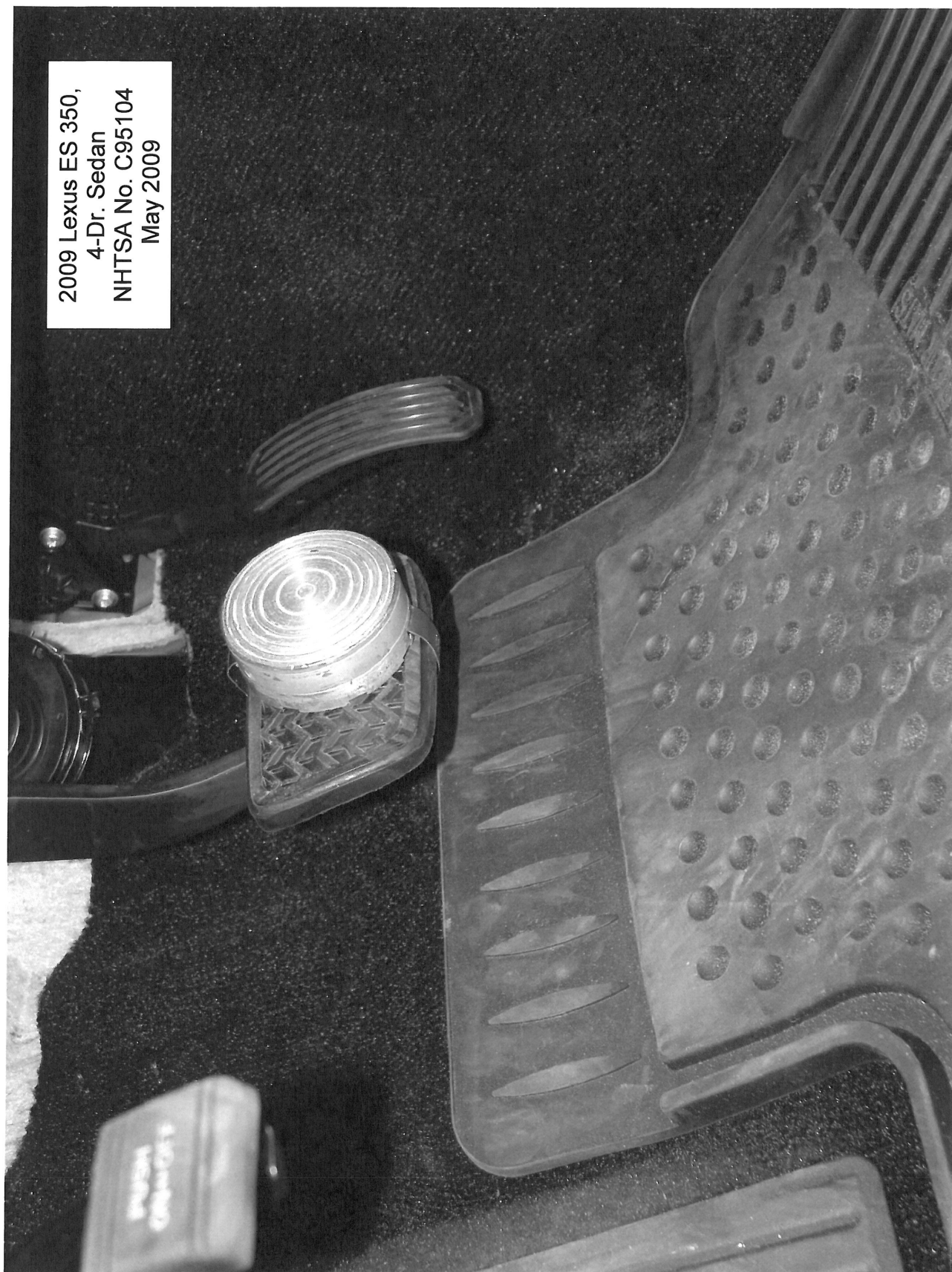


Test Instrumentation in Vehicle

2009 Lexus ES 350,  
4-Dr. Sedan  
NHTSA No. C95104  
May 2009



Test Instrumentation in Vehicle

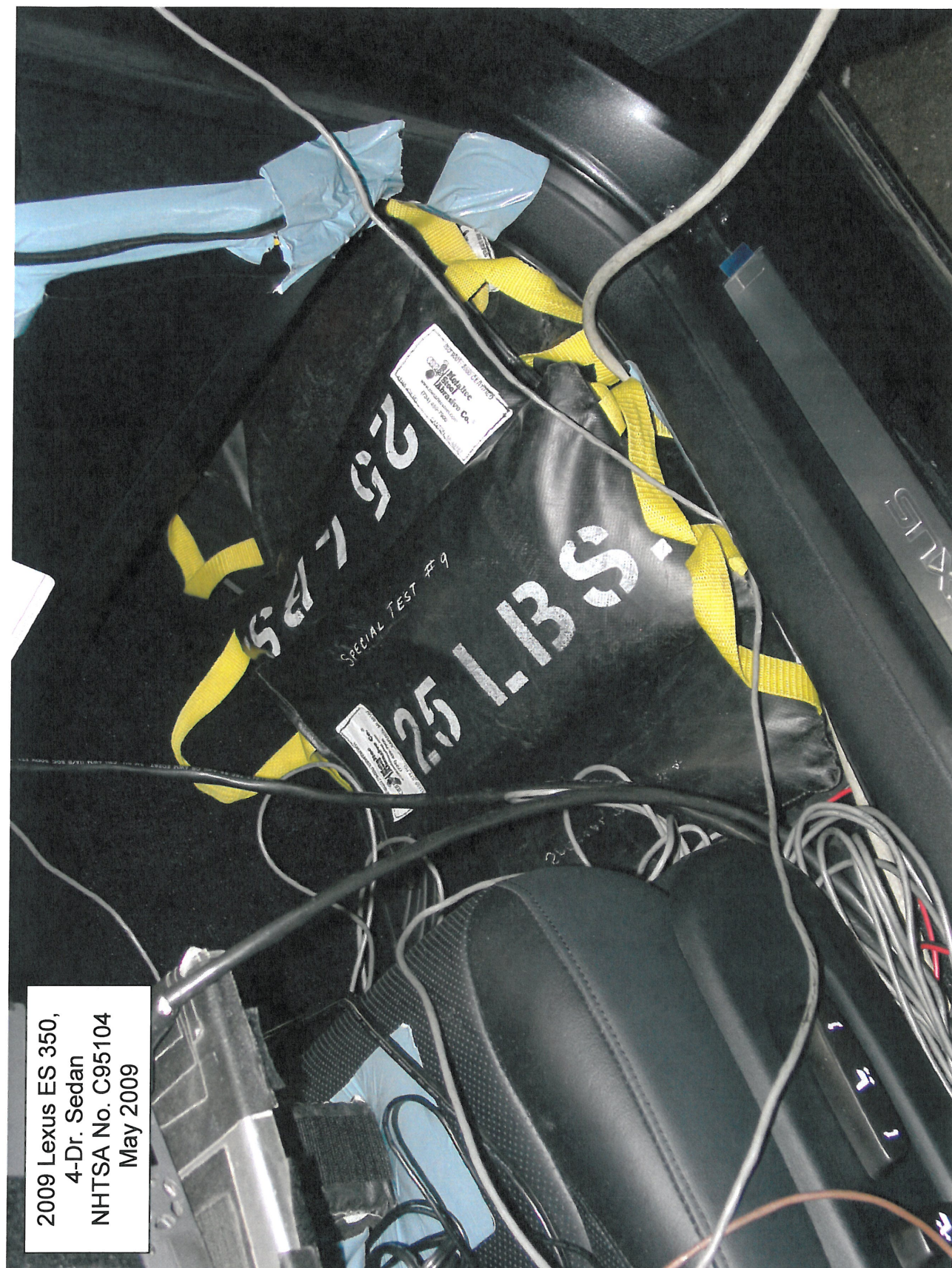


Test Instrumentation in Vehicle

2009 Lexus ES 350, 4-  
Dr. Sedan  
NHTSA No. C95104  
May 2009



Vehicle Being Weighed



2009 Lexus ES 350,  
4-Dr. Sedan  
NHTSA No. C95104  
May 2009

Ballast in Vehicle



2009 Lexus ES 350,  
4-Dr. Sedan  
NHTSA No. C95104  
May 2009

Ballast in Vehicle



2009 Lexus ES 350,  
4-Dr. Sedan  
NHTSA No. C95104  
May 2009

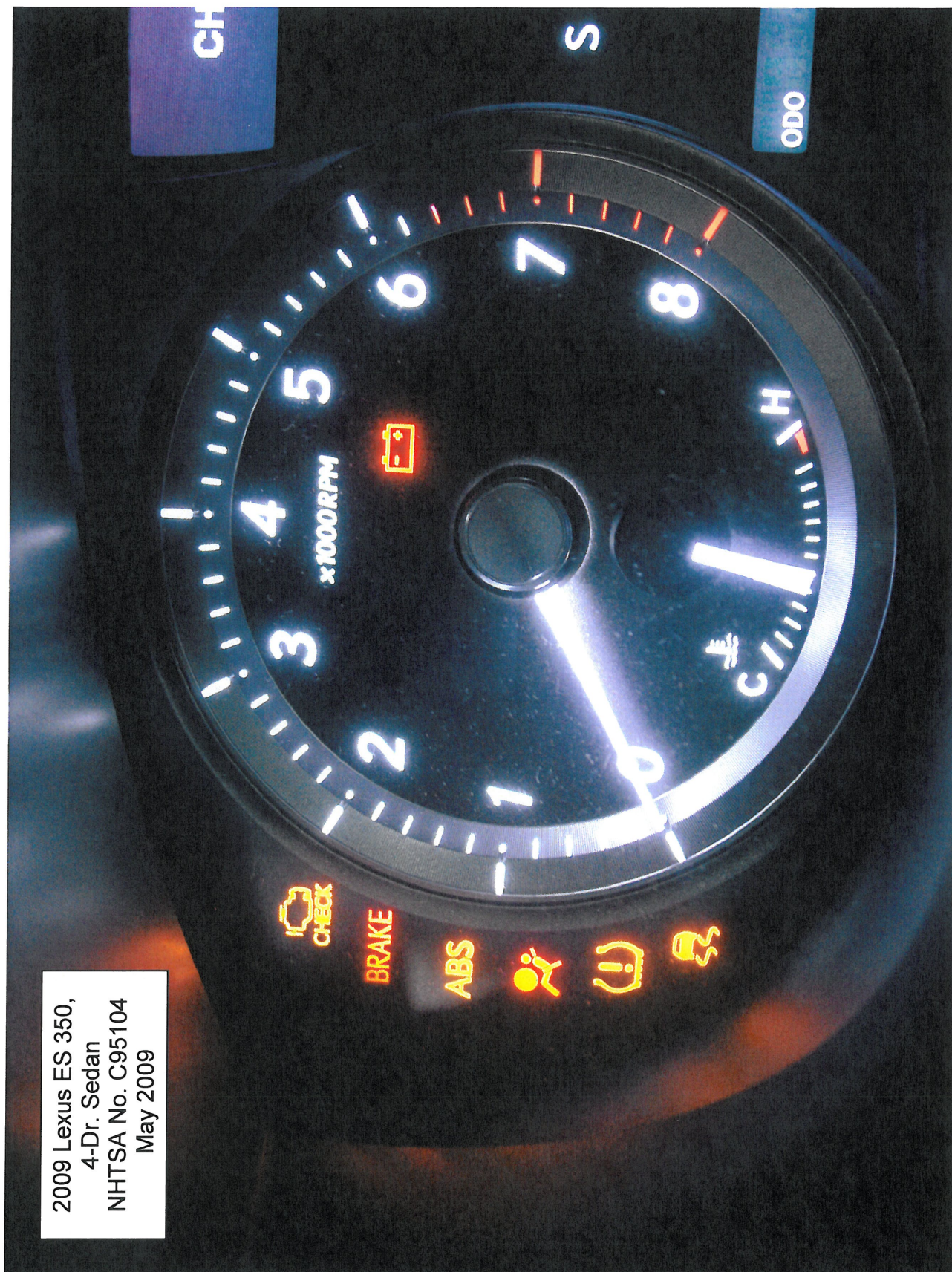
Ballast in Vehicle



2009 Lexus ES 350,  
4-Dr. Sedan  
NHTSA No. C95104  
May 2009

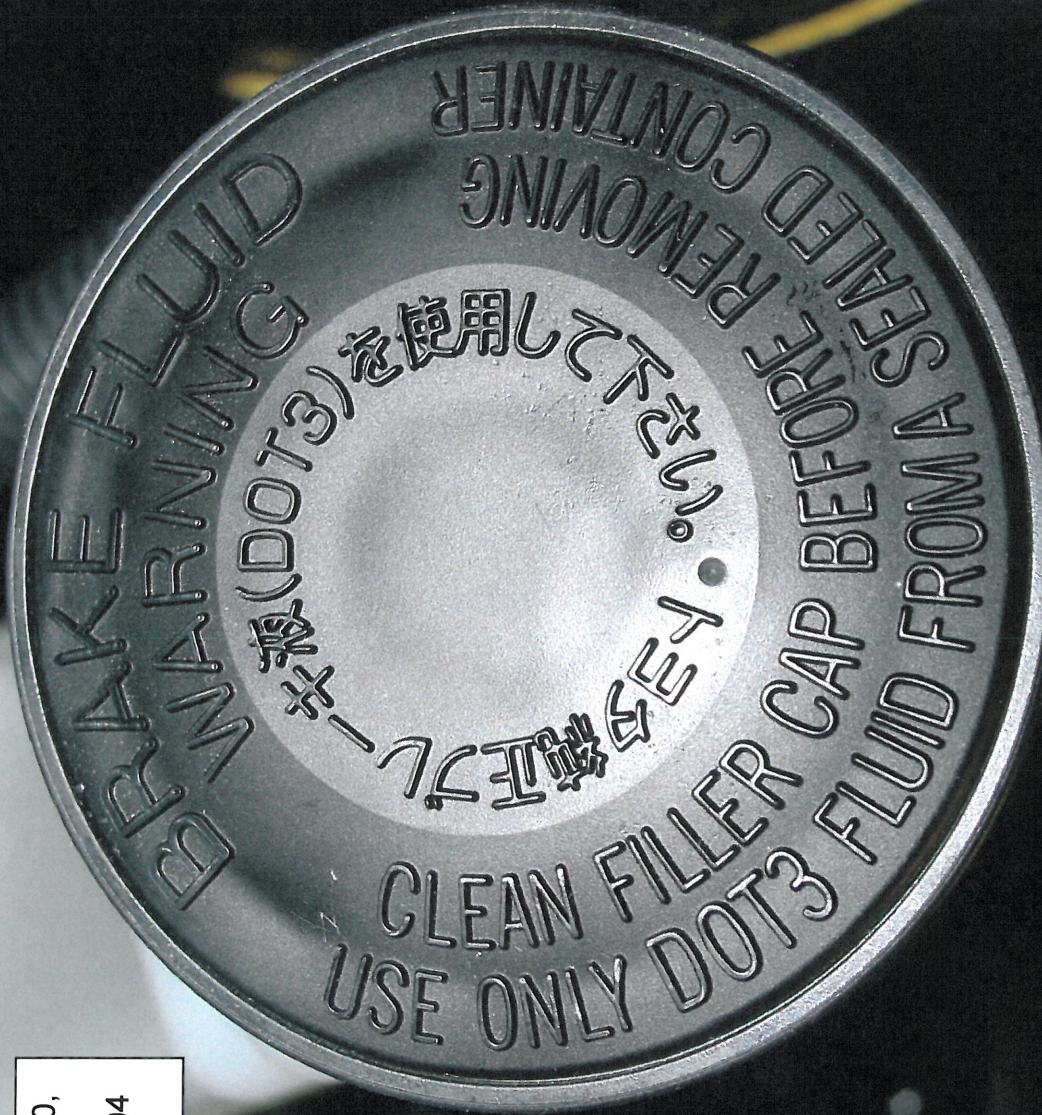
Ballast in Vehicle

2009 Lexus ES 350,  
4-Dr. Sedan  
NHTSA No. C95104  
May 2009



Brake System and ABS Indicator (Warning) Lamps

2009 Lexus ES 350,  
4-Dr. Sedan  
NHTSA No. C95104  
May 2009



Brake System (Master Cylinder) Reservoir Warning Label

## 7.0 INSTRUMENT CALIBRATION (12 MONTH MAXIMUM INTERVAL)

VEHICLE: 2009 Lexus ES 350;

NHTSA NO.: C95104;

DATE: 05/01/09

INSTRUMENT	SERIAL NUMBER	CALIBRATION DATE	NEXT CALIBRATION
Data Acquisition System - Link DAS 2060	955009	11/10/08	11/10/09
Computer – Toshiba/Link Engrg.	TRC-43366	Not Applicable	Not Applicable
Software - Link Engrg. Rev Data	TRC Propr.	NA	NA
LF Torque Wheel	Not Utilized		
RF Torque Wheel	Not Utilized		
LR Torque Wheel	Not Utilized		
RR Torque Wheel	Not Utilized		
Stopwatch – Fisher Scientific (Heating Snubs)	SN-97216633	08/27/08	08/27/09
Stopwatch – Accusplit (Daily Cals)	SW-ST03	08/27/08	08/27/09
Tire Pressure Gauge – WIKA	AG-101 97216633	02/05/09	05/06/09
Pedal Force Transducer – Sensor Devel.	169755	Each Test	Each Test
Asst. Pipe-Handle Steel Weights - Ohaus	LB-0001	06/04/08	06/04/09
Park Brake Force Transducer – Lebow	LC-42631	Each Test	Each Test
LF Hydraulic Pressure Transducer	Not Utilized		
RF Hydraulic Pressure Transducer	Not Utilized		
LR Hydraulic Pressure Transducer	Not Utilized		
RR Hydraulic Pressure Transducer	Not Utilized		
Accelerometer - Setra (+ or – 15 g) 141A	A-118555	Each Test	Each Test
Fifth Wheel – ADAT DSR6/1aa Radar	1400082	Each Test	Each Test
Wind Velocity/Direct. – Davis Model 6410	050608N22	07/13/08	07/13/09
Ambient Temp. Gage–Davis Mod. 6150	050608N02	07/13/08	07/13/09
LF Brake Thermocouple - Temprel/Link	T52-0B-24K	Ea. Test w/Link	Ea. Test w/Link
RF Brake Thermocouple - Temprel/Link	T52-0B-24K	Ea. Test w/Link	Ea. Test w/Link
LR Brake Thermocouple - Temprel/Link	T52-0B-24K	Ea. Test w/Link	Ea. Test w/Link
RR Brake Thermocouple - Temprel/Link	T52-0B-24K	Ea. Test w/Link	Ea. Test w/Link
Lock-up Detection System	TRC Propr.	Each Test	Each Test
Vehicle Weight – Toledo/Mettler Scales JAGXTREME 3000000, (Bldg. 70)	SN 5225831- 5JC	02/18/09	05/18/09

Quality Assurance: \_\_\_\_\_

# DAILY CALIBRATIONS (1 of 3)

Vehicle: 2009 Lexus ES 350

NHTSA No.: C95104

## Deceleration Calibration Data for Unit 9355

Desired full scale value is: 9.81 m/s/s

Allowed deviation is: + or - 0.15 m/s/s

Accelerometer      Level to zero, then tilt to  
full scale

"Date"	"Time"	Zero	Cal
"stp"	"stp"	"Decel"	"Decel"
5/4/2009	11:09:50	0.02	9.80
5/5/2009	9:07:19	-0.03	9.80
5/5/2009	15:17:21	-0.05	9.65
5/6/2009	8:42:31	0.08	9.80
5/7/2009	8:47:29	-0.01	9.90
5/7/2009	15:37:38	0.02	9.78
5/8/2009	10:11:18	-0.36	9.69
5/11/2009	8:28:14	0.16	9.88
5/11/2009	15:21:25	0.10	9.82
5/12/2009	9:16:37	-0.20	9.68
5/13/2009	10:19:37	0.04	9.80

POST-CAL

## Pre-Test Linearity Check 05/04/2009

Actual (m/s/s)	Rec. (m/s/s)
0.0	0.0
3.0	3.0
6.1	6.1
9.8	9.8

## Post-Test Linearity Check 05/13/2009

Actual (m/s/s)	Rec. (m/s/s)
0.0	0.0
3.0	3.0
6.1	6.1
9.8	9.8

## Distance Calibration Data for Unit 9355

Desired full scale value is: 1000 m

Allowed deviation is: 3 m

Light beam      Drive from 0 to 100 to 0 km/h  
distance sensor      on a measured kilometer

"Date"	"Time"	Distance for
"stp"	"stp"	1000 meters
5/4/2009	14:58:42	1000.3
5/5/2009	9:12:48	1002.2
5/5/2009	15:20:21	1001.9
5/6/2009	8:50:53	999.9
5/7/2009	12:16:27	1000.3
5/7/2009	15:42:55	1000.4
5/8/2009	10:13:55	1001.3
5/11/2009	8:33:37	1000.3
5/11/2009	15:26:48	1000.6
5/12/2009	9:19:34	1000.3
5/13/2009	9:01:04	1000.3

# DAILY CALIBRATIONS CONTINUED (2 of 3)

Vehicle: 2009 Lexus ES 350

NHTSA No.: C95104

Wheel Tachometer Calibrations for Unit 9355

Wheel tachometer calibrations: all wheel speeds should be 15 km/h

Wheel Lock Detector	While at a standstill, check zeros. Drive vehicle at approx. 15 km/h and engage zero speed switch for each wheel	"Date"	"Time"	Zero	@15km/h	Zero	@15km/h	Zero	@15km/h	Zero	@15km/h
		stp	stp	LF	LF	RF	RF	LR	LR	RR	RR
		5/7/2009	12:08:32	-0.1	15.5	-0.1	16.3	-0.1	15.8	-0.1	15.5
		5/7/2009	15:39:11	-0.1	15.5	-0.1	16.3	-0.1	15.9	-0.1	15.6
		5/8/2009	10:12:59	-0.1	16.2	-0.1	17.0	-0.1	16.4	-0.1	16.2
		5/11/2009	8:29:48	-0.1	15.4	-0.1	16.2	-0.1	15.6	-0.1	15.3
		5/11/2009	15:22:46	-0.1	15.3	-0.1	25.3	-0.1	15.8	-0.1	15.3
		5/12/2009	9:18:20	-0.1	15.4	-0.1	25.6	-0.2	24.6	-0.1	15.4
		5/13/2009	8:59:10	-0.1	15.6	-0.1	16.0	-0.1	15.8	-0.1	15.5

When driven over 15 km/hr and the wheel tack generators are shunted to zero volts, does the graphical screen indicate wheel lock at each wheel position? X Yes \_\_\_\_ No.

Pedal Force Meter Calibration for Unit 9355

Target shunt calibration is 799 N

Desired recorded value is: 799 N

Desired recorded actual force calibration check value is: 500 N

Allowed deviation is: 6.5 N

Service brk. Driver  
pedal effort engages a  
fixed shunt  
cal switch.

"Date"	"Time"	Zero	Cal Val
stp	stp	Force	Force lb
5/4/2009	10:42:08	-1.9	802.8
5/5/2009	9:06:13	-1.8	800.6
5/5/2009	15:15:50	-2.2	800.4
5/6/2009	8:40:59	-1.9	801.0
5/7/2009	8:45:50	-2.7	800.9
5/7/2009	15:36:54	-2.0	800.7
5/8/2009	10:09:43	-0.7	800.5
5/11/2009	8:25:54	-2.0	800.9
5/11/2009	15:19:50	-2.4	800.6
5/12/2009	9:14:48	-2.1	800.5
5/13/2009	10:13:00	-1.6	800.7

POST-CAL

Pre-Test Linearity Check - 05/04/09

Actual	Recorded
Force (N)	Force (N)
0	0
222	222
445	445
498	498

Post-Test Linearity Check - 05/13/09

Actual	Recrdd
Force (N)	Frc(N)
0	0
222	223
445	445
498	498

Parking Brake Transducer Cal: Shunt Cal - 938 N, Unit 9355 - 05/12/09

Pre-Test

Actual	Recorded
Force (N)	Force (N)
0	0
222	222
445	445
498	498

Post-Test

Actual	Recrdd
Force (N)	Frc(N)
0	0
222	223
445	445
498	498

# DAILY CALIBRATIONS CONTINUED (3 of 3)

Vehicle: 2009 Lexus ES 350

NHTSA No.: C95104

Dynamic Speed Calibration for Unit 9355

Desired speed value is: 100 km/h

Allowed deviation is: 1.6 km/h

Desired time value is: 36 seconds

Allowed deviation is: + or - 0.6 seconds

Light beam Drive vehicle  
speed sensor at a steady  
100 km/h  
through a  
kilometer.

"Date"	"Time"	"Speed"	Time"
stp	stp	km/h	sec
5/4/2009	15:01:59	99.8	35.91
5/5/2009	9:19:11	100.2	36.21
5/5/2009	15:23:30	100.8	35.90
5/6/2009	8:54:14	99.7	36.40
5/7/2009	12:24:11	99.8	36.06
5/7/2009	15:41:25	100.4	36.03
5/8/2009	10:17:20	100.5	35.90
5/11/2009	8:37:19	100.0	36.34
5/11/2009	15:29:56	100.3	36.09
5/12/2009	9:23:16	99.8	36.12
5/13/2009	9:04:21	99.5	36.05

## APPENDIX A

Copy of Manufacturer's Sticker



DESCRIPTION  
COLOR  
VIN  
PORT/PLANT

2009 / 9000A ES350 4-DR SEDAN  
SMOKY GRANITE MICA  
JTHBJ46GX92295416  
Portland, OR

Dealer Name / Address:  
GERMAIN LEXUS OF DUBLIN  
3885 W. DUBLIN-GRANVILLE  
DUBLIN  
OH43017

Ship to: (Dealer, unless otherwise indicated)

- STANDARD EQUIPMENT & INSTALLED OPTIONS**
- PERFORMANCE FEATURES**
- 3.5 Liter 272HP Four Cam 24-Valve V6 Engine
  - All-Aluminum Engine Construction & Dual VVT-i
  - 6-Speed Automatic Transmission w/Sequential Shift
  - Front Wheel Drive
  - Dual Exhaust with Chrome Finished Tips
  - 4-Wheel Independent MacPherson Strut-Type Suspension with Gas Pressurized Shock Absorbers
  - Front and Rear Stabilizer Bar
  - 4-Wheel Power Assisted Ventilated Front/Solid Rear Disc Brakes
  - 17" Aluminum Alloy 7-Spoke Wheels
  - 215/65R17 All-Season Tires
- SAFETY FEATURES**
- Dual Front Airbags, Dual Front Knee Airbags, Front Seat-Mounted Side Impact Airbags, Fr & Rr Side Curtain Airbags, Supplemental Restraint Sys (SRS)
  - 3-Point Seatbelts for All Seating Positions
  - Fr & Rr Outboard Seatbelt Pretensioners with Force Limiters
  - Vehicle Stability Control (VSC) with TRAC
  - 4-Wheel Anti-Lock Braking System (ABS) with Electronic Brakeforce Distribution (EBD)
  - Energy Managing Crumple Zones, Side Door Beams
  - Theft-Deterrent System w/ Engine Immobilizer
  - Projector-Bulb Headlamps w/ Integrated Foglamps/Daytime Running Lights (DRL)
  - Variable Intermittent Wipers with Mist Control
- LUXURY AND CONVENIENCE FEATURES**
- Tire Pressure Monitor System
  - Tool Kit and First Aid Kit
  - SmartAccess with Push Button Start/Stop
  - 10-Way Power Adjustable Driver & Passenger Seats includes 2-way Power Lumbar
  - Electrochromic Auto-Dimming Interior Mirror
  - Heated Outside Mirrors
  - One-Touch Open/Close Pwr Tilt-and-Slide Moonroof
  - Automatic Dual Zone Climate Control
  - Automatic On/Off Headlamps
  - Lexus Premium Audio System w/In-Dash 6-Disc CD Player, Automatic Sound Levelizer (ASL) & MP3
  - Player Connectivity (miniplug) & 8-Speakers
  - Power Front and Rear Windows with Auto One-Touch Up/Down and Pinch Protection
  - Power Door Locks with Anti-Lock Out
  - Power Tilt/Telescoping Steering Wheel w/Audio & Display Functions & Column-Mounted Cruise Control
  - Key FOB-Integrated Multi-Function Remote Entry Sys
  - Rear Glass Imprinted Antenna w/FM Diversity Sys
  - Front Cup Holders with Adjustable Holder Ring
  - Rear Arm Rest with Cup Holders
  - Heavy-Duty Rear Window Defogger with Timer
  - Scheduled Maintenance Indicator Light
  - Lexus Personalized Settings
  - LED Interior Lighting
  - Carpeted Floor Mats

**\$ 34,320.00**

250.00  
300.00  
205.00  
1,280.00

330.00  
210.00  
109.00

## EPA Fuel Economy Estimates

These estimates reflect new EPA methods beginning with 2008 models.

**CITY MPG**

**19**

Expected range for most drivers  
16 to 22 MPG

**Estimated Annual Fuel Cost**  
**\$ 2,935**

based on 15,000 miles at \$4.30 per gallon

**Combined Fuel Economy**  
**This Vehicle**

**22**

11 46  
All Midsize Cars

**HIGHWAY MPG**

**27**

Expected range for most drivers  
22 to 32 MPG

Your actual mileage will vary depending on how you drive and maintain your vehicle.

## GOVERNMENT SAFETY RATINGS

<b>Frontal Crash</b>	<b>Driver</b>	★★★★★
	<b>Passenger</b>	★★★★★
Star ratings based on the risk of injury in a frontal impact. Frontal ratings should ONLY be compared to other vehicles of similar size and weight.		
<b>Side Crash</b>	<b>Front seat</b>	★★★★★
	<b>Rear seat</b>	★★★★★
Star ratings based on the risk of injury in a side impact.		
<b>Rollover</b>		★★★★★
Star ratings based on the risk of rollover in a single vehicle crash.		

Star ratings range from 1 to 5 stars (★★★★★) with 5 being the highest.  
Source: National Highway Traffic Safety Administration (NHTSA).

[www.safercar.gov](http://www.safercar.gov) or 1-888-327-4236

SUB-TOTAL **\$ 37,004.00**

DELIVERY, PROCESSING AND HANDLING FEE **825.00**

**TOTAL \$ 37,829.00**

APPLICABLE FEDERAL TAXES NOT INCLUDED

Manufacturer's suggested retail price includes manufacturer's recommended pre-delivery service.
Licenses and title fees, state, local and applicable federal taxes, and dealer installed options and accessories are not included in the manufacturer's suggested retail price.
<b>LEXUS NEW VEHICLE LIMITED WARRANTY</b> <ul style="list-style-type: none"><li>• 4YR / 50,000 mile basic coverage</li><li>• 8YR / Unlimited mile powertrain coverage</li><li>• 6YR / Unlimited mile corrosion perforation warranty</li></ul>
See your Warranty and Services Guide for details.
<b>LEXUS IS PLEASED TO OFFER THE FOLLOWING OWNER SUPPORT PACKAGE WITH EACH NEW LEXUS</b> <ul style="list-style-type: none"><li>• 24 hour, 365 day/yr. roadside assistance plan</li><li>• Complimentary 1st and 2nd scheduled maintenance services</li><li>• Lodging for emergency breakdowns 100 miles from home for this vehicle. *Ask dealer for details</li></ul>

324A12 289 WCO8 N-9122



## APPENDIX B

### Discussion on Data

## DISCUSSION ON DATA

### Symbols for Brake Components

4	-	4 Wheel	G	-	Groan	DL	-	Deceleration (State FPSPS)
X	-	Skid	SQ	-	Squeal	PF	-	Pedal on Floor
L	-	Left	SQK	-	Squeak	SCP	-	Shoe Scrape
R	-	Right	PO	-	Pinchout	RB	-	Rubber Banding
R	-	Rear	P	-	Pull	O	-	Odor
F	-	Front	R	-	Shudder	NOX	-	No Skid
B	-	Both	M	-	Momentary			

INT or INIT	-	Initial Part of Stop
MID	-	Middle of Stop
END	-	End of Stop

All stops were made manually.

## APPENDIX C

### Contractor's Comments Procedure Modifications and Test Facility

Comments for vehicle C95104.

For all recorded decelerations:

The recorded *average* deceleration values for the tests are slightly lower than that which is required or targeted for certain test sections. However, in all cases and in reality, the driver maintained the correct required/target deceleration values for the majority of time for each of those stops. The recorded deceleration is acquired from the moment the service brake pedal is moved until the vehicle reaches zero speed. Therefore, the time needed to achieve the target deceleration (rise time) and the time the vehicle goes from the target deceleration to zero (fall time) is included in the average deceleration calculation. The rise and fall times were added to the entire length of the stops. Hence, the recorded average deceleration values were generally and slightly less than the required/target deceleration values.

For Data Sheet 16 – Antilock Functional Failure at LLVW, the “ABS” and “BRAKE” lamps came on as well as the check engine warning lamp. Additionally, the speedometer and odometer became non-functional. These same warning lamps and non-functional items occurred during testing for Data Sheet 22 – Antilock Functional Failure at GVWR.

The Hydraulic Circuit Failure Tests were not performed to the lab procedure sequence to both save time and cause minimal disruption to the hydraulic brake system. Sequence: Circuit #1 @ LLVW, Circuit #2 @ LLVW, Circuit #2 @ GVWR, and Circuit #1 @ GVWR.

The manufacturer's response provided dimensions for the fully worn lining thickness that appeared to allow a significant of lining remaining on the brake pad. Therefore, per the Standards Engineer, another calculation was performed using the "zero" lining default for the fully worn lining thickness to compare and confirm there was sufficient fluid volume remaining available in the reservoir for this condition.

#### Procedure and Example for Determining Master Cylinder Volume Requirement

The procedure followed for determining the minimum volume requirements is outlined in the example shown below. The required data is taken from the previous page, both measured and manufacturer's data.

#### DISC BRAKES

Volume Required,  $V_r = (\Delta t_i + t_{ic} + \Delta t_o + t_{oc}) \times [\pi (D^2)]/4$ , where –

$V_r$  = Volume required per wheel

$\Delta t$  = Change in thickness (average)

i = Inboard

o = Outboard

D = Caliper cylinder diameter

c = Average clearance

Using the above equations, the volume requirements for Subsystem No. 1 (LF/RR) and Subsystem No. 2 (RF/ LR) were calculated utilizing measured and manufacturer's provided data to create the greatest displacement, as shown below:

$$\begin{aligned} \text{Disc Brake: } V_r &= (\Delta t_i + t_{ic} + \Delta t_o + t_{oc}) \times \frac{\pi D^2}{4} \\ \text{(Front)} \\ \Delta t_i &= 12 \text{ mm} \\ \Delta t_o &= 12 \text{ mm} \\ t_{ic} + t_{oc} &= 0 \text{ mm} \\ D &= 63.5 \text{ mm} \\ V_r &= (12.0 + 0 + 12.0 + 0) \frac{\pi (63.5)^2}{4} \\ &= 24 (3166.92) \\ &= 76006.1 \text{ mm}^3 = 76.0 \text{ ml (x1 Pistons)} = 76.0 \text{ ml} \end{aligned}$$

$$\begin{aligned} \text{Disc Brake: } V_r &= (\Delta t_i + t_{ic} + \Delta t_o + t_{oc}) \times \frac{\pi D^2}{4} \\ \text{(Rear)} \\ \Delta t_i &= 10.5 \text{ mm} \\ \Delta t_o &= 10.5 \text{ mm} \\ t_{ic} + t_{oc} &= 0 \text{ mm} \\ D &= 38.1 \text{ mm} \\ V_r &= (10.5 + 0 + 10.5 + 0) \frac{\pi (38.1)^2}{4} \\ &= 21 (1140.09) \\ &= 23941.9 \text{ mm}^3 = 23.9 \text{ ml (x1 Piston)} = 23.9 \text{ ml} \end{aligned}$$

For System 1 (LF & RR)

$$V_{r1} = 76006.1 \text{ mm}^3 + 23941.9 \text{ mm}^3 = 99948.0 \text{ mm}^3$$

$$V_{r1} = 99948.0 \text{ mm}^3 = (99.9 \text{ ml})$$

For System 2 (RF & LR)

$$V_{r2} = V_{r1}$$

$$V_{r2} = 99948.0 \text{ mm}^3 = (99.9 \text{ ml})$$

$$\text{TOTAL VOLUME REQUIRED} = V_t = V_{r1} + V_{r2} = 99.9 + 99.9 = 199.8 \text{ ml}^*$$

Note: There is 329 ml of total fluid capacity within the master cylinder reservoir.

### 7.5-MILE TEST TRACK

The 7.5-mile test track encloses a 1,600-acre area, one mile wide and 3.5 miles long.

The track has a downward grade, north to south, of 0.228 percent and a cross slope in the straightaways of 3/16 inch per foot. The 1.88 mile long straightaways flow into transition areas 2,300 feet in length and then into 5,275-foot long curves with a constant radius of 2,400 feet. The 36-foot wide straightaways and the 42-foot wide curves provide three test lanes. Paved berms, 12 feet in width, border the straightaways and the inside of the curves.

As a vehicle moves toward the outside of the track in the curves, it encounters a progressively steeper bank. The inside lane (or "slow" lane) has a bank of 10 degrees allowing a neutral speed of 80 mph with no side forces. In the center lane, the slope increases to 19 degrees resulting in a neutral speed of 110 mph. The outside lane's 28-degree bank allows a 140 mph neutral speed. Rimming the outer lane is a seven-foot safety lane culminating in a 36-degree slope at the guardrail.

The facility is paved with Portland cement concrete. It carries a maximum single axle load of 36,000 pounds and a maximum tandem axle load weight of 48,000 pounds. Special provisions can be made for heavier weight loads.

With 22.5 lane miles, our track will accommodate many vehicles simultaneously. Research which utilizes the track includes component performance and durability studies, brake tests, aerodynamic studies, fuel economy studies, drive line efficiency tests, and the determination of vehicular acceleration and cruise characteristics. In addition, it supports maximum speed determination, road load power, noise and emission measurements and tire durability test programs.

The 7.5-mile test track can be used in conjunction with other facilities at TRC. It provides an excellent area for pre-test conditioning of equipment such as brake burnishing, tire break-in, and vehicle warm-up.

## TRC SKID PAD

The Skid Pad is a test facility which is utilized primarily for the evaluation of tire and brake systems.

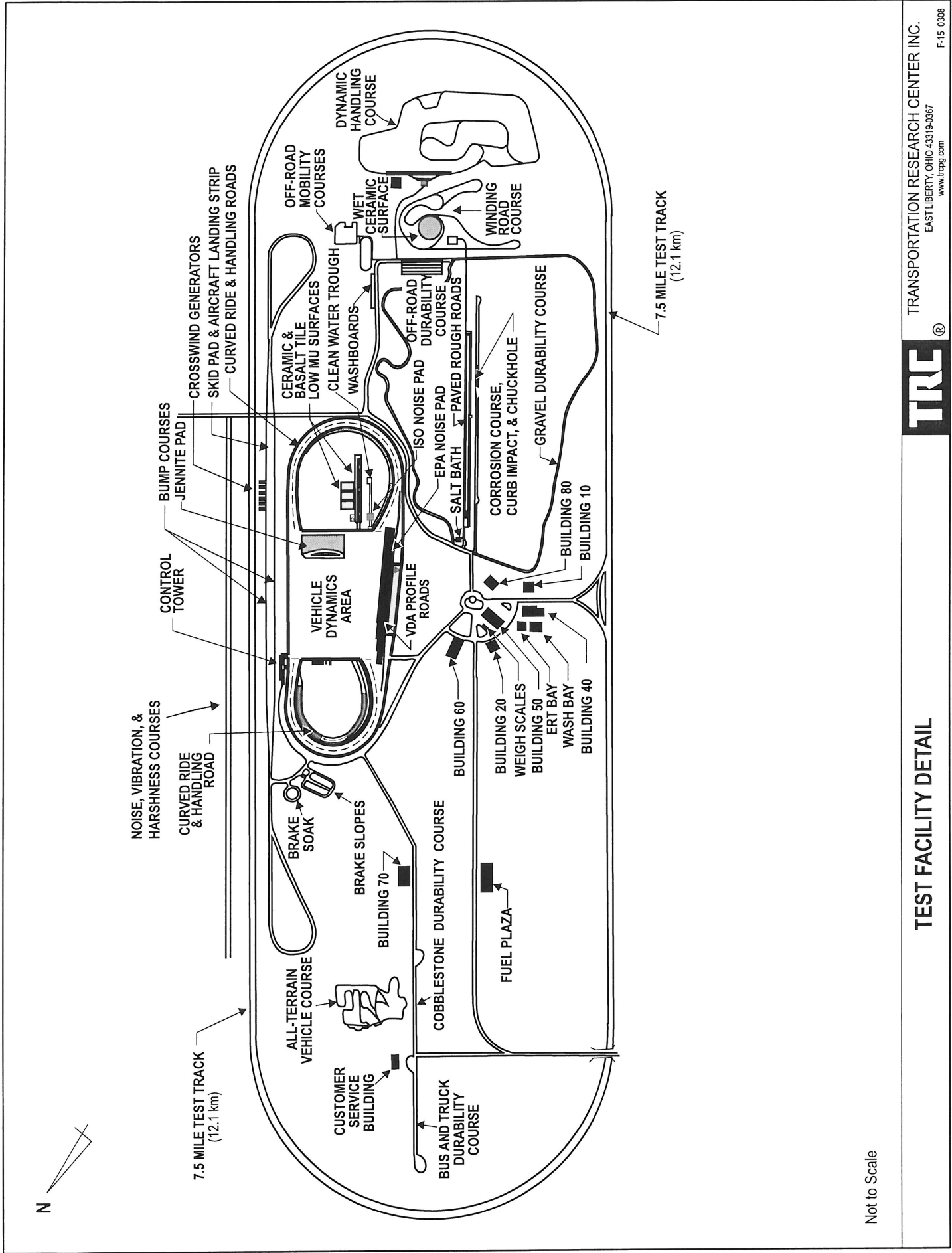
The overall dimensions of the pad are 9,000 feet by 84 feet with loops on the north and south ends. Both turnaround loops have a 309-foot radius and are 16 feet wide with a 25 percent super elevation. They will accommodate speeds of 45 mph with zero side force and 60 mph with .5 g's lateral acceleration. The acceleration/deceleration lanes at each end are 3,280 feet in length.

A test area of 210,000 square feet is situated in the center of the skid pad containing several test pads with varying surface textures. Skid numbers in this area range from 30 (wet) to 80 (dry).

The skid pad is paved with Portland cement. The load capacity of the skid pad is 36,000 pounds maximum single axle weight and 48,000 pounds maximum tandem axle weight.

Varying surface textures in the main test area are ideal for testing tire and/or brake system performance on different surfaces as characterized by "skid numbers." The skid pad is also used for acceleration studies, aerodynamics, rolling resistance, noise testing, and vehicle top speed determination.

The subject test vehicle was rear wheel anti lock equipped. Rather than rapidly and fully applying the service brake control, the driver modulated the service brake control as necessary to control/prevent front wheel lock.

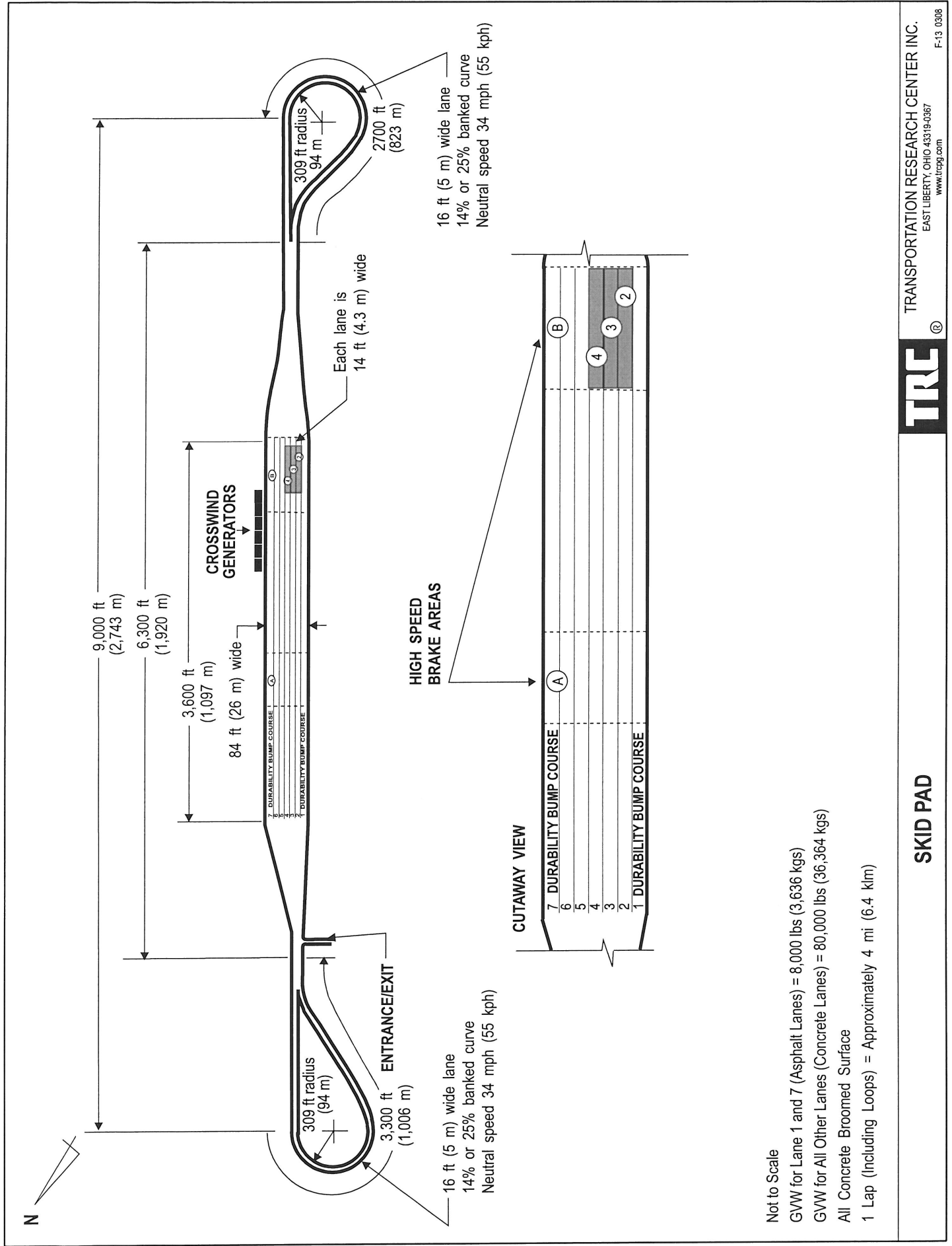


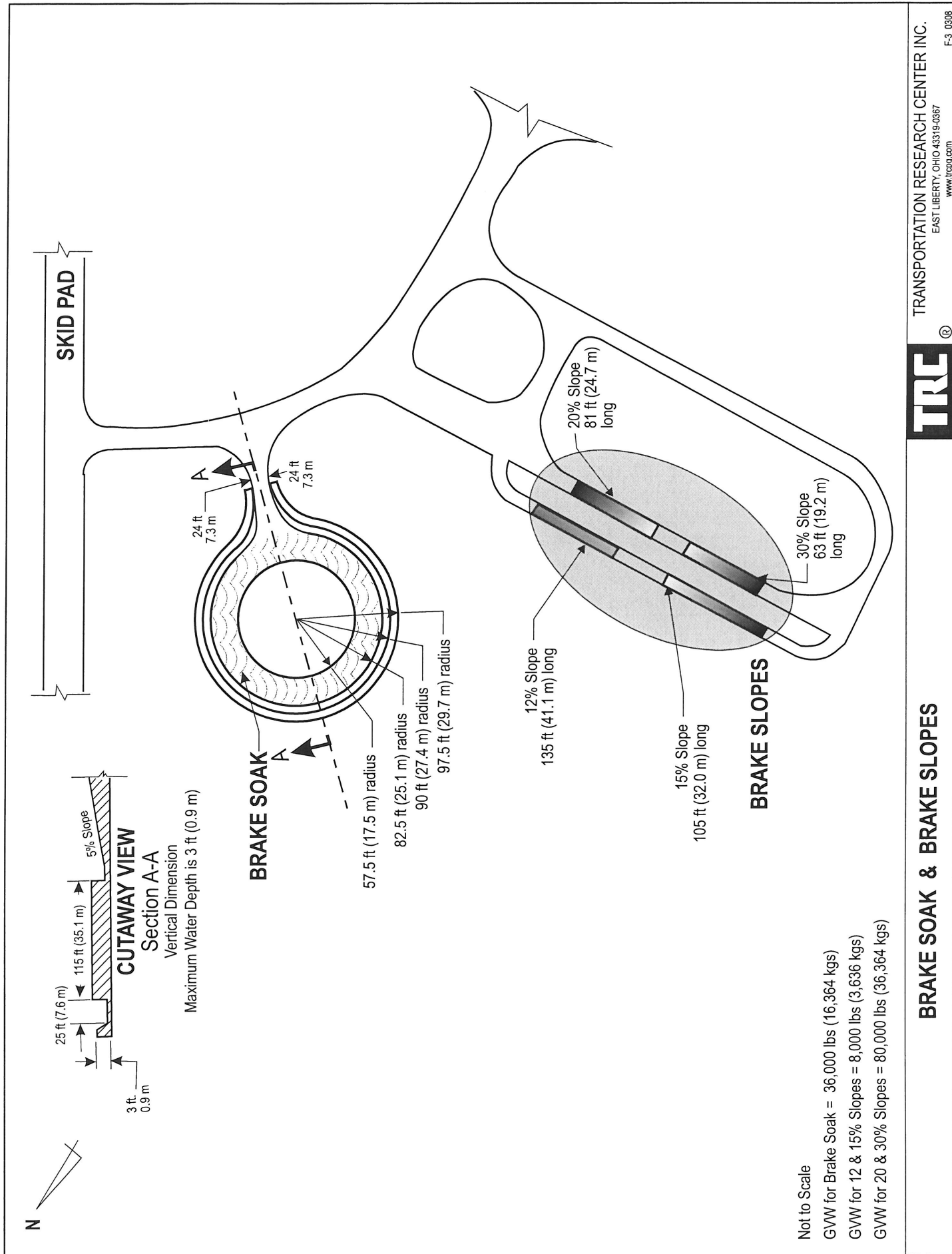
Not to Scale

# TEST FACILITY DETAIL



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EAST LIBERTY, OHIO 43319-0367  
www.trcg.com





## BRAKE SOAK & BRAKE SLOPES



TRANSPORTATION RESEARCH CENTER INC.

EAST LIBERTY, OHIO 43319-0367

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F-3 0308



APPENDIX D  
Notice of Possible Non-Compliance

This vehicle (C95104) met the requirements of the FM VSS 135 Standard.